APPENDIX A—1.

No. 3403.

GOVERNMENT OF INDIA.

DEPARTMENT OF COMMERCE AND INDUSTRY.

(INDUSTRIES.)

RESOLUTION.

Simla, the 19th May 1916.

The Government of India, as announced by Sir William Clark when speaking on Sir Ibrahim Rahimtoola's Resolution in the Legislative Council on 21st March 1916, have decided that the time has come when the question of the expansion and development of Indian manufactures and industries should be taken up in a more comprehensive manner than has hitherto been attempted. India possesses two notably successful manufacturing industries in the two great textile industries of cotton and jute, and there are others which have also reached some degree of importance; but it remains none the less true that she is still in the main a producer of raw materials. The Government of India have strong hopes, however, that it may prove possible to place the industries of this country on a much firmer and more extended basis than at present, and they consider that no means should be left untried which holds out a reasonable hope of effecting this end. They are aware of the eager desire of a large number of the people of India for the industrial development of their country, and with this desire the Government of India fully associate themselves.

The efforts of Government in the past towards this end have disclosed the existence of numerous difficulties. Indian capital is timid and unenterprising; skilled labour is lacking; and there is a want of practical information regarding the commercial potentialities of India's raw products. All these difficulties require full examination by men of technical experience and high business standing. The Government of India have, therefore, decided to appoint a Commission, some of whose members will be acquainted with Indian conditions, some with industrial progress in other countries where similar objects have been pursued, and others with industrial problems generally and their business side in particular. The Government of India are well aware that there are special difficulties in the way of such an enquiry during war time, but after full consideration it has been decided to appoint the Commission at once in order that, when after the close of the war the financial position is once more established on a normal basis, the Government may be able without further delay to take such action as may seem suitable after considering the Commission's recommendations.

2. In framing the terms of reference it has been found necessary to exclude two matters from the scope of the Commission's labours. In the first place, any consideration of the present fiscal policy of the Government of India has been excluded from its enquiries. When introducing the Financial Statement in the Legislative Council, the Honourable Finance Member, it will be remembered, stated, in connection with the question of the cotton duties, that the general fiscal relationship which exists between the various parts of the Empire and other countries must, in the opinion of His Majesty's Government, be reconsidered after the war, and that in the meantime they wish to postpone any action that would tend to raise such questions. The same considerations apply with even greater force to any proposals involving the imposition of duties for the specific purpose of protecting Indian industries, a policy which would very directly affect the fiscal relations of India with the outside world. In the next place, it is not proposed that the Commission should re-examine those aspects of technical and industrial education which have recently been dealt with by Committees working in England and India whose reports are at present under the consideration of the Government of India.

3. Subject to the above qualifications, the Commission will be instructed to examine and report upon the possibilities of further industrial development in India and to submit its recommendations with special reference to the following questions:—

(a) whether new openings for the profitable employment of Indian capital in commerce and industry can be indicated;

(*b*) whether and, if so, in what manner, Government can usefully give direct encouragement to industrial development—

(*i*) by rendering technical advice more freely available;

(*ii*) by the demonstration of the practical possibility on the commercial scale of particular industries;

(*iii*) by affording directly or indirectly financial assistance to industrial enterprises; or

(*iv*) by any other means which are not incompatible with the existing fiscal policy of the Government of India.

The Government of India trust that the Commission will find it possible to place their report in the hands of the Government of India within 12 months from the date of its assembling in India.

4. The Commission will consist of the following gentlemen:—

PRESIDENT.

1. SIR T. H. HOLLAND, K.C.I.E., D.Sc., F.R.S.,
President of the Institution of Mining Engineers.

MEMBERS.

2. MR. ALFRED CHATTERTON, C.I.E., B.Sc., F.C.G.I., A.M.I.C.E., M.I.M.E.,
Director of Industries and Commerce in Mysore.

3. THE HON'BLE SIR FAZULBHOY CURRIMBHOY EBRAHIM, KT.,
Messrs. Currimbhoy Ebrahim and Company, Bombay.

4. MR. EDWARD HOPKINSON, M.A., D.Sc.,
Managing Director, Mather and Platt, Manchester, and
Deputy Chairman, Chloride Electric Company

5. THE HON'BLE MR. C. E. LOW, C.I.E., I.C.S.,
Secretary to the Government of India, Department of
Commerce and Industry.

6. THE HON'BLE PANDIT MADAN MOHAN MALAVIYA, B.A., LL.B.,
of Allahabad.

7. SIR RAJENDRA NATH MUKERJI, K.C.I.E.,
Messrs. Martin and Company, Calcutta.

8. THE RIGHT HON'BLE SIR HORACE CURZON PLUNKETT,
P.C., D.C.L., LL.D., F.R.S., K.C.V.O.

9. THE HON'BLE MR. F. H. STEWART, C.I.E.,
President, Bengal Chamber of Commerce.

10. SIR DORABJI JAMSETJI TATA, KT., J.P.,
Messrs. Tata, Sons and Company, Bombay.

The Secretary will be appointed later.

Ordered that a copy of this Resolution be forwarded to all Local Governments and Administrations, with the request that the Commission may be given any assistance which they may require and that any applications for information which may be made by the Commission may be complied with.

Ordered also that a copy of the Resolution be forwarded to all Departments of the Government of India, to the Director-General of Commercial Intelligence, to the President and Members of Commission, and that the Resolution be published in the *Supplement to the Gazette of India.*

C. E. LOW,
Secretary to the Government of India.

APPENDIX A—2.

PRELIMINARY NOTE ON THE SCOPE OF ENQUIRY BY THE INDIAN INDUSTRIAL COMMISSION.

I.—INTRODUCTION.

1. The scattered information already available regarding the resources of India in raw material the suitability of the people for expert labour, and the probable financial resources of

the country, is sufficient to show that there are room and opportunity for a very substantial development of manufacturing and other industries.

2. It will be the business of the Commission, after establishing the fundamental proposition by a critical analysis of the facts, to suggest the most profitable lines of action with the object—

(a) of drawing out capital now lying idle;

(b) of building up an artisan population;

(c) of carrying on the scientific and technical researches required to test the known raw materials and to design and improve processes of manufacture;

(d) of distributing the information obtained from researches and from the results of experience in other countries; and

(e) of developing the machinery for—

(1) financing industrial undertakings, and

(2) marketing products.

3. As the result of the examination of Government records and preliminary discussion with various authorities, the following suggestions have been made regarding problems likely to come before the Commission. These suggestions are now being distributed among the Local Governments with a view of obtaining further suggestions during the current monsoon tour.

4. The President will be grateful for any suggestions in addition to, or in modification of, those given below, in order that, at the end of the monsoon, it will be possible to sketch out a tour programme for the Commission, and to frame a list of questions for the assistance of witnesses.

II.—COLLECTION OF PRELIMINARY INFORMATION.

5. The Commission will assemble during October next, and, as soon as possible afterwards, will proceed by touring through the provinces, to collect evidence through independent witnesses, representatives of local Committees and institutions, and by personal inspection of industrial enterprises.

6. In view of the limited time at the disposal of the Commission, it would be an advantage in each of those provinces not already provided with a Director of Industries or an Advisory Board, to organise at once a representative Committee assisted, if practicable, by an officer on special duty. Steps to this end have already been taken by some of the Local Governments.

7. These representative Provincial Committees would be responsible for giving precision to questions that are now being discussed vaguely in general terms, for example, by stating them for concrete cases. The Provincial Committees would compile lists of raw materials available locally and suitable for the establishment of new industries, and also lists of raw materials that might be imported as accessory material, or even as the principal raw material with the same object. From this and other information at their disposal, they would form lists of industries already tried or new, that appear to be suitable for encouragement according to the special circumstances of each province, calling attention to enterprises that have been obviously successful or offer distinct promise of success. They might profitably make detailed and, when necessary, confidential studies of a few typical examples of recent failures, in order that the causes which have contributed to such failures may be brought to the notice of the Commission. They would also advise the Commission as to the names of suitable individual or representative witnesses.

8. It is suggested that, during the next cold weather tour, the time at the disposal of the Commission in each province might be divided as follows:—

(a) examination of individual witnesses, with, as convenient,

(b) visits to typical works or industrial centres, followed by

(c) a general conference between the Commission and the representative Provincial Committee.

9. The Commission will devote from a fortnight to three weeks to each of the larger provinces, and it will be an advantage to obtain from each Local Government, before the end of September, a programme indicating the most suitable centres for taking evidence and the most suitable places for visits to representative industries. It will be necessary to obtain, about the same time, a list of the individual witnesses nominated, in order that they may be supplied, about the middle of October, with a series of questions for the preparation of their preliminary written statements. It may be possible, in some cases, however, to nominate after this date additional witnesses on special subjects, but the Provincial Committees will doubtless take care that, in giving such advice, the programme in each case is not overloaded.

III.—DEVELOPMENT OF OFFICIAL ADMINISTRATION.

10. Under this heading arise problems connected with the establishment or development of Imperial and Provincial Departments which are concerned, in one way or another, with

industrial enterprise. In some provinces, there are already at work Directors of Industries, assisted by technical experts and in some cases, advised by Boards of Industries, while in other provinces, proposals for a similar organisation are under consideration. It is obvious that, to effect improvements in the unorganised or cottage industries, such as hand-loom weaving, and in any industry in which local circumstances completely supersede technical considerations, the establishment of provincial departments is likely to be advantageous; but for some of the larger industries, in which purely technical matters are paramount, it may be advisable to form Imperial Departments.

11. It has been suggested that such central organisations might be formed for some of the following:—

(*a*) chemistry, including agricultural, metallurgical, tinctorial, and pharmaceutical chemistry;

(*b*) the leather and hide industries;

(*c*) glass-making;

(*d*) sugar and alcohol manufactures;

(*e*) paper-making; and

(*f*) oil-seed industries.

12. Opinions might be obtained as to whether any Imperial Departments of this description should be constituted, and, if so, for what subjects. The nature of their administration should also be considered, that is, whether their heads should be purely advisory, with inspecting powers, as in the Forest Department, or should have administrative and executive control as in the smaller and more specialised Geological Survey Department.

13. It will be important also to obtain evidence as to the organisation of Provincial Industrial Departments, and the advisability of instituting Provincial Boards of Industries, or Advisory Committees, to include non-official members. Evidence as to the constitution and functions of these Boards or Committees should be obtained.

14. Finally, it will be necessary to obtain opinions regarding the relationship of a Provincial Industries Department with an Imperial Department of the kind mentioned in paragraph 11.

15. Evidence might also be obtained on the following points:—

(*a*) the suitability of the present system of collecting and distributing statistics and commercial intelligence, by the Director of Statistics and the Director-General of Commercial Intelligence, respectively;

(*b*) the advantages of establishing or assisting special journals for the chief industries and also general industrial and trade journals;

(*c*) any recognisable advantages which have followed the issue of special monographs and other Government publications such as those of the Forest and Geological Departments;

(*d*) the formation of commercial museums, and of sales agencies or of commercial emporia, in the principal towns of India and possibly abroad, for the display and the sale of the products of unorganised cottage industries;

(*e*) the institution of periodical industrial exhibitions;

(*f*) the appointment of trade representatives in other provinces, and, for the whole of India, in Great Britain, the Colonies and foreign countries;

(*g*) the possibility of establishing some system of Government certificates regarding the quality of products, accompanied by the institution of testing laboratories;

(*h*) the regulations of trade marks and the working of the patent laws; and

(*i*) the suitability of the present law for the acquisition of land on behalf of industrial companies.

IV.—GOVERNMENT AID TO INDUSTRIES.

16. Evidence might suitably be collected regarding the experience so far obtained of financial and technical assistance rendered to industrial enterprises, and opinions might be obtained as to the most suitable form in which Government aid can be given to existing or to new industries.

17. The following methods have been suggested, and some have been tried, at different times:—

(*a*) loans and money grants-in-aid;

(*b*) supply of machinery and plant by Government on the hire-purchase system;

(*c*) guaranteed dividends for a limited period, with or without subsequent refund to Government of the expenditure incurred in paying dividends at the guaranteed rate;

(*d*) guaranteed Government purchase of products for limited periods;

(*e*) concessions of land;

(*f*) special railway transport facilities and rates;

(*g*) bounties and subsidies;

(*h*) pioneering industries and handing them over to private companies;

(*i*) loan of services of Government-employed experts.

18. With regard to any of these forms of direct Government assistance, it will be important to obtain opinions as to whether, and to what extent, they should be accompanied by Government control, as for instance, by the appointment of Government Directors for the period during which the direct assistance lasts. The information collected by officers placed on special duty will assist the Provincial Committees and the Commission in considering the extent to which Government aids to new enterprises will compete with those already existing and with established external trades.

V.—TECHNICAL AND SCIENTIFIC WORK.

19. (*a*) What can be done to improve the labourers' efficiency and skill, generally or in particular industries? What advantages have followed from the establishment of industrial schools? What experience has been gained in training apprentices in factories or workshops?

(*b*) What steps are desirable for the improvement of supervisors of all grades and of skilled managers? Should assistance be given to these, or to technical experts of private firms, or to Government officials, to study conditions and methods in other countries? It is important to obtain some idea as to the benefits that have been gained by the deputation of officers abroad for special enquiries, or on ordinary study leave.

(*c*) What noticeable benefits have local industries received from researches conducted by Government Departments?

(*d*) What experience has been gained from demonstration factories? It would be interesting to obtain opinions as to where, and what kind of, factories should be instituted in each province.

(*e*) Problems have been referred at times to the Scientific and Technical Department of the Imperial Institute; it is important to obtain from those who have utilised the Institute opinions as to the relative merits of conducting researches in India and in England.

(*f*) It is understood that the activities of the new Advisory Council for Research in the United Kingdom may extend to India and Colonies; it will be useful to have opinions from scientific and technical men as to ways in which this opportunity may be utilised.

(*g*) It is important to obtain opinions as to the most suitable way of developing technological research institutions, such as the Indian Institute of Science. Should these be general in their interests or be confined to limited groups of related subjects, and should they be imperial in their interests, or be maintained as provincial institutions?

(*h*) Whether the time has come when measures should be adopted to prevent the unnecessary overlapping of research activities by Technical Departments, special Technological Institutes, and University Colleges?

VI.—MISCELLANEOUS QUESTIONS.

20. Evidence might be obtained regarding the following questions:—

(*a*) Facilities for the development of hydro-electric power and the positions of apparently suitable power sites in the various Provinces.

(*b*) The effect of railway freight rates on local industries. Are there any practicable changes that can be made with apparent advantage, or are there any railway extensions that are necessary to develope possible new industries, or to extend existing industries? What waterways can be improved with advantage?

(*c*) Have any local difficulties been noticed in the working of the new mining and prospecting rules issued in September 1913? Are there any minerals that are essential for industries of imperial importance that ought to be developed at public expense, for example, minerals of direct importance for the manufacture of munitions of war, or substances which are ordinarily obtained in commerce only from one country?

(*d*) Can the forest policy be modified so as to permit of reducing the cost of assembling raw forest products, as for example, by the concentration of special kinds of trees in limited areas, and by improved forest transport facilities?

(*e*) In view of the report of Sir Edward Maclagan's Committee, it is important to obtain opinions as to what extent, and in connection with what industries, co-operative societies can be encouraged.

(*f*) In connection with the points already noticed in paragraph 15, regarding the collection and distribution of information under Government agency, could the principal Government departments which use imported articles assist Indian industries by publishing lists of these articles, or by exhibiting the articles in commercial museums?

(*g*) The possibility of formulating a scheme for financing, by existing or new banking agencies, the marketing of indigenous products.

APPENDIX A—3.

INSTRUCTIONS TO PERSONS INVITED TO GIVE EVIDENCE BEFORE THE COMMISSION.

IT IS NOT INTENDED THAT INDIVIDUALS OR BODIES INVITED TO GIVE EVIDENCE SHOULD ATTEMPT TO ANSWER ALL THE QUESTIONS.

The Commission will naturally attach importance to the practical experience and special knowledge which witnesses have acquired of the matters regarding which they offer opinions.

1. The questions in the accompanying lists have been framed so as to cover, as far as practicable, the whole scope of the enquiry to be made by the Indian Industrial Commission.

2. Each witness will also be examined orally by the Commission. At the oral examination, he will probably be examined on his written evidence in order to make clear doubtful points, and otherwise to enable the Commission to estimate its value.

3. A Chamber of Commerce or similar body invited, as a Chamber or body, to give evidence, may either submit one set of answers to the questions, which it desires to answer, and select not more than three representatives to support its views in oral examination ; or it may nominate two or three individuals to give each his own views, in writing and afterwards orally. These individuals may be selected either as representing different interests or as having knowledge and experience of different subjects, or as representing different views on one or more subjects.

Individuals who are members of Chambers of Commerce or similar bodies may give evidence, at their own request or by invitation, independently of these arrangements. The evidence of these witnesses will be taken as representing their individual views only.

4. In answering the printed list of questions, *witnesses need not restrict themselves to a series of answers to the questions* on which they desire to give evidence. The questions are intended merely as a guide to show witnesses the matters on which the Commission desires to gather information and opinions. *The Commission prefers that witnesses should submit their views in a connected statement for each subject,* and include in each such statement their answers to the various questions.

5. Witnesses who desire that any portions of their evidence should be treated as confidential are requested clearly to mark such portions. Oral evidence will also be treated as confidential when witnesses so desire. They will be given the opportunity of revising the proofs of their oral evidence.

QUESTIONS FOR THE ASSISTANCE OF WITNESSES.

I.—FINANCIAL AID TO INDUSTRIAL ENTERPRISES.

Capital.

1. Please state if you have had any experience of the raising of capital for industrial enterprises ?

If so, what difficulties have you found in doing so ?

What suggestions have you to make for removing these difficulties ?

2. What are the sources from which capital for industrial enterprises is principally drawn ?

2 (a). Can you suggest any new sources from which capital may be drawn ?

3. Do you know of any kinds of industrial enterprises where more concerns have been started than can be maintained in full-time employment ?

If so, please describe the general conditions.

Government assistance.

4. What is your knowledge or experience of financial aid by Government to industrial enterprises ?

5. What are your opinions on the following methods of giving Government aid to existing or new industries :—

(1) money grants-in-aid ;
(2) bounties and subsidies ;
(3) guaranteed dividends for a limited period, with or without subsequent refund to Government of the expenditure incurred in paying dividends at the guaranteed rate ;
(4) loans, with or without interest ;
(5) supply of machinery and plant on the hire-purchase system

(6) provision of part of share capital of companies on the same basis as public subscriptions of capital ;

(7) guaranteed or preferential Government purchase of products for limited periods ; and

(8) exemption for a limited period of the profits of new undertakings from income-tax ; and exemption from any tax on an industry, or on any article used in an industry.

6. In which methods of Government assistance should there be Government control or supervision ?

What should be the form of such control or supervision ? (*E.g.*, Government audit or appointment of Government directors with defined powers for the period during which direct assistance lasts.)

Pioneer factories.

7. What is your experience or opinion of Government pioneer factories ?

[NOTE.—By pioneer factories are meant those established primarily to ascertain whether a new industry is commercially practicable ?

By demonstration factories (see questions 19 and 20) are meant those established primarily for giving demonstrations of, and instruction in, improved methods for industries which have been proved to be commercially practicable.]

8. In what ways and to what extent should Government pioneer industries ?

At what stage should pioneer factories be either closed or handed over to private capitalists or companies ?

What limits and restrictions, if any, should be imposed on the conversion of successful pioneering experiments into permanent Government enterprises ?

Financing agencies.

9. In your experience what industries are hampered by the conditions under which they are financed as going concerns ?

Please describe the method of financing and its effect on the industry in each case.

10. In what ways is it possible to give more assistance to industrial undertakings by existing or new banking agencies ?

10 (*a*). Do you think there is need of a banking law ?

[See also question 39.]

Co-operative societies.

11. Do you know of any industries which have been developed or assisted by the formation of co-operative societies ?

What were the exact means adopted and what were the results obtained ?

12. In your experience what are the industries for which co-operative societies should be encouraged.

What should be the organisation and special objects of these societies ?

12 (*a*). What suggestions have you to make for industrial development by means of Trade Guilds, such as exist in other countries ?

How far should the State encourage the promotion of such Guilds ?

Limits of Government assistance.

13. What principles should be followed in order to prevent Government aid competing with existing or discouraging fresh, private enterprises.

14. Should there be any limitations on Government aid to a new enterprise if it competes with an established external trade ?

II.—TECHNICAL AID TO INDUSTRIES.

Technical aid in general.

15. What is your personal knowledge or experience of technical and scientific aid provided by Government to industrial enterprise ?

16. What is your personal knowledge or experience of noticeable benefits received by local industries from researches conducted by Government departments ?

17 On what conditions should the loan of Government experts be made to private firms or companies ?

18. Under what restrictions and conditions would you allow publication of the results of researches made by a Government-paid expert while attached to a private business ?

Demonstration factories.

19. Can you suggest any industry for which Government demonstration factories should be adopted and on what lines ? (See note below question 7.)

20. Should any demonstration factories be instituted in your province ?

Research abroad.

21. What has been your experience of the aid afforded by the Scientific and Technical Department of the Imperial Institute ?

What are its advantages and disadvantages ?

22. In addition to arrangements made for research in India, is it advantageous to have provision for research for special subjects in the United Kingdom ?

If so, for what special purposes is it advantageous to conduct researches in England rather than in India ?

23. In what ways can the Advisory Council for Research in the United Kingdom give assistance to Indian industries?

24. Can you suggest for this country any system, similar to that of the Advisory Council for Research in the United Kingdom, for referring research problems to Colleges and other appropriate institutions in India? (See questions 75 and 76.)

Surveys for industrial purposes.

25. Does the existing knowledge of the available resources of the country—agricultural, forest, mineral, etc.—require to be supplemented by further surveys?

26. How should such a survey be organised?

What should be its precise objects?

27. How should its results be made most useful to industries?

27 (*a*). What is your experience or opinion of the value of Consulting Engineers appointed by Government to aid industrial enterprise by technical advice and by the supply of plans and estimates?

(*b*) Should such Consulting Engineers be allowed to undertake the purchase of machinery and plant for private firms or individuals? If so, under what conditions?

[See questions 63 *et seq.*]

III.—ASSISTANCE IN MARKETING PRODUCTS.

Commercial museums.

28. What is your experience or opinion of commercial museums, *e.g.*, that in Calcutta?

29. If you think commercial museums should be developed and increased in number what suggestions have you to make regarding their situation, arrangement and working.

Sales agencies.

30. What is your experience or opinion of sales agencies or commercial emporia for the sale as well as the display of the products of minor and unorganised cottage industries.

How should they be developed?

Exhibitions.

30 (*a*). Would travelling exhibitions of such industries be of advantage?

31. What is your opinion or experience of the value of industrial exhibitions?

32. Should Government take measures to hold or to encourage such exhibitions?

If so, what should be the Government policy?

33. What should be the nature of such exhibitions?

Should they be popular in character, or should they aim merely at bringing sellers and buyers into contact?

Trade representatives.

34. Should trade representatives be appointed to represent the whole of India, in Great Britain, the Colonies and foreign countries?

What should be the qualifications of these trade representatives?

How should their duties be defined?

35. In addition to these trade representatives would it be suitable in some cases also to have temporary Commissions for special enquiries?

36. Should provinces in India itself have trade representatives in other provinces?

How should such representation be arranged for?

Government patronage.

37. Should the principal Government departments which use imported articles publish lists of these articles, or exhibit them in commercial museums?

38. With reference to the encouragement of Indian industries, have you any criticisms to offer regarding the working of the present rules relating to the purchase of stores by Government departments?

Have you any changes to propose in the rules themselves.

Banking facilities.

39. In what way is it possible to assist in marketing indigenous products by more banking facilities, either through existing agencies (such as the Presidency, Exchange, Joint Stock and Co-operative Credit Banks) or through new agencies (such as Industrial and Hypothec Banks)? (See also question 10.)

IV.—OTHER FORMS OF GOVERNMENT AID TO INDUSTRIES.

Supply of raw materials.

40. What conditions should control the supply of Government-owned raw materials (*e.g.*, forest products) on favourable terms?

Land policy.

41. Is there any check at present imposed on industrial development in your province by the land policy of Government?

If so, what remedies do you suggest?

(NOTE.—The expression " land policy " is intended to cover laws and regulations relating to settlements, the Government assessment, rents, tenant rights, permission to use land for industrial purposes, and generally all matters connected with the ownership and use of land.)

42 On what principles should Government give concessions of land for the establishment of new, or the development of existing industries?

43 What criticisms have you to make regarding the working of the present law for the acquisition of land on behalf of industrial companies?

What modifications of the law do you recommend?

43(*a*). In what ways and on what terms can Government assist in the provision of subterranean or surplus surface water for industrial purposes.

V.—TRAINING OF LABOUR AND SUPERVISION.

General.

44(*a*). Do you think that the lack of primary education hinders industrial development?

(*b*) What has been done in any industry of which you have had experience to improve the labourers' efficiency and skill?

45. What steps do you consider should be adopted to improve the labourers' efficiency and skill—

(*a*) generally, and

(*b*) in any industry of which you have had experience?

Apprenticeship system and industrial schools.

46. What special knowledge or experience have you of the training of apprentices in factories and workshops?

47. What advantages have you observed to follow from the establishment of industrial schools?

48. On what lines should these two systems of training (*i.e.*, apprenticeship system and industrial schools) be developed and co-ordinated?

49. What has been your experience of day schools for short-time employees, or of night schools?

How should these be developed?

50. Should industrial and technical schools and commercial colleges be under the control of the Department of Education or of a Department of Industries?

What measures should be adopted in order that these two departments should work in unison in controlling industrial schools?

Training of supervising and technical staff.

51. What measures are necessary for the training and improvement of supervisors of all grades and of skilled managers?

52. What assistance should be given to supervisors, managers and technical experts of private firms to study conditions and methods in other countries? (See question 77.)

53. In what circumstances and under what conditions should industries assisted by Government be required to train technical experts?

Mechanical engineers.

54. Is there a want of uniformity in the standard of examinations for mechanical engineers held in the various provinces where engineers in charge of prime-movers are required in certain cases to be certificated?

If so, should measures be adopted to make such tests uniform so that the Local Governments and Administrations may reciprocate by recognising each other's certificates?

55. If the law in your province does not require any qualifications in an engineer in charge of a prime-mover, have you any criticisms or suggestions to make?

VI.—GENERAL OFFICIAL ADMINISTRATION AND ORGANISATION.

56. What provincial organisation exists in your province for the development of industries?

What criticism have you to make regarding its constitution and functions?

57. What organisations do you recommend for the future development of industries in your province?

Should there be a Board of Industries?

If so, what should be the functions of such a Board?

Should it be merely advisory or should it have executive powers with budgetted funds?

58. If you recommend an Advisory Board, how should it be constituted?

59. If you recommend a Board with powers, what should be its constitution and how should its powers be defined?

60. Should there be a Director of Industries?

What should be his functions?

Should he be a business man, or a non-expert official, or a technical specialist?

What other qualifications should he possess?

61. If you recommend both the formation of a Board of Industries and the appointment of a Director of Industries, what should be the relations between the Board of Industries, the Director of Industries and the Provincial Government or Administration?

62. What form of machinery do you propose in order to correlate the separate activities of the various provinces as regards industries?

Is it practicable to form an Imperial department under a single head?

If so, what should be the functions of such a department?

Cottage industries.

62(*a*). Should there be special measures taken or special sections of a Department of Industries organised for the assistance of cottage industries?

62(*b*). Please explain in detail what should be the Government policy as regards cottage industries and how it should be carried into effect? In this connection, see especially questions 11, 30, 64 and 72.

62(*c*). What cottage industries do you recommend should be encouraged in this way?

VII.—ORGANISATION OF TECHNICAL AND SCIENTIFIC DEPARTMENTS OF GOVERNMENT.

General.

63. Are there in your province any technical and scientific departments which are capable of giving assistance to industries?

If so, what criticisms have you to make regarding their organisation?

What changes do you recommend?

Imperial department.

64. In order to aid industrial development do you recommend the formation of any new Imperial Scientific and Technical Departments?

If so, for what subjects or natural groups of subjects?

65. How should such an Imperial department be constituted and recruited?

66. What should be the powers of the head of the department?

If he has executive control of the department, what should be his relationship to the Imperial Government?

67. What should be the relationship of an expert, whose services are loaned by the Imperial department to a Local Government, with the Local Government and the latter's Department of Industries?

Provincial departments.

68. For what subjects should Local Governments engage their own experts or organise their own technical and scientific departments?

69. Under what direct control should these experts and departments be placed?

70. On what terms should these experts be employed?

Technological institutions.

71. What is the most suitable way of developing technological research institutions, such as the Indian Institute of Science?

71(*a*). Should there be a Technological Institute for each province, and should such Institutes be allowed to develop as independent units, or should they be fitted into a general development scheme for the whole of India, with a central Research Institute?

72. As regards investigation and research should each Institute be general in its activities and interests, or should each deal with limited group of related subjects?

73. Should there be any Government control?

If so, should this control be imperial or should it be purely provincial or local?

Co-ordination of research.

74. Is it desirable that measures should be taken to co-ordinate and prevent unnecessary overlapping of the research activities in Government Technical and Scientific Departments, special Technological Institutes and University Colleges?

If so, what are your suggestions?

75. What noticeable results have followed from the institution of the Indian Science Congress?

76. Can you suggest any ways in which the Congress might become more useful in assisting industrial development? (See question 24.)

Study of foreign methods.

77. What encouragement should be given to Government technical and scientific experts to study conditions and methods in other countries? (See question 52.)

Reference libraries.

78. What difficulties have you experienced in consulting technical and scientific works of reference?

79. Have you any suggestions to make regarding the establishment of libraries of such works?

Colleges of Commerce.

80. Do you think that the establishment of a College of Commerce is necessary in your province?

If so, on what lines should it be organised?

81. In what ways do you expect such a college to assist industrial development?

81(*a*). In what ways can Municipalities and Local Boards assist in promoting industrial and commercial development?

VIII.—GOVERNMENT ORGANISATION FOR THE COLLECTION AND DISTRIBUTION OF COMMERCIAL INTELLIGENCE.

Statistics.

82. Have you any criticisms to offer on the present system of collecting and distributing statistics by the Director of Statistics?

What changes do you suggest?

Commercial intelligence.

83. Have you any criticism to offer on the present system of collecting and distributing commercial intelligence by the Director-General of Commercial Intelligence?

What modifications do you suggest?

Industrial and trade journals.

84. What advantages have you found in the issue of the "Indian Trade Journal"?

85. Should Government establish or assist industrial or trade journals, either for general or special industries, which would be of real use to persons actively engaged in industries?

86. What proposals do you make for the dissemination of information of this kind through the various vernaculars?

Other publications.

87. What advantages have you known to follow the issue of special monographs on industrial subjects or publications like those of the Forest and Geological Departments?

What measures do you advise in order to increase the usefulness of these publications?

88. Are there any other directions in which Government could collect and publish information of a kind likely to assist industries and trades?

IX.—OTHER FORMS OF GOVERNMENT ACTION AND ORGANISATION.

Certificates of quality.

89. Are there any products for which a system of Government certificates of quality should be established?

For what products should such certificates be compulsory, and for what products voluntary?

90. What should be the organisation for testing each class of products and granting certificates?

Prevention of adulteration.

91. Are there any classes of materials for manufacture or of manufactured articles for the adulteration of which penalties should be imposed.

92. For each such class of goods what organisation do you suggest for purposes of inspection and prosecution of offenders?

Misdescription.

93. Have you any other suggestions to make in regard to the prevention of misdescription of goods generally?

Trade marks and trade names.

94. What is your opinion on the present state of Indian law relating to marks and descriptions of proprietary and other articles of trade.

Patent laws.

95. Have you any criticisms or suggestions to make regarding the existing law and regulations relating to patents?

Registration of partnerships.

96. Is it desirable and practicable in the interests of trade, to introduce a system of registration or disclosure of partnerships?

Roads, railways and waterways.

97. To what extent does the lack of transport facilities by road, rail or water hinder industrial development in your province?

Have you any specific recommendations to make?

98. Have you any criticisms to offer regarding railway freights, the classification of goods, the apportionment of risk, and the regulation of rates?

What are your proposals?

99. Are there any railway extensions necessary in your province to develope new or to extend existing industries?

100. Similarly, are there any waterways which should be constructed, extended or improved?

Shipping freights.

101. Are you aware whether the external trade or internal industries of the country are handicapped by any difficulties or disadvantages as regards shipping freights?

Can you suggest any remedies?

Hydro-electric power surveys.

102. What has been done in your province towards ascertaining the possibilities of developing hydro-electric power?

Should further investigation be made in this matter?

102 (*a*). Have you any criticisms to make regarding the effect of the Electricity Act on industrial enterprise?

Mining and Prospecting Rules.

103. What difficulties have been experienced in the working of the Mining and Prospecting Rules (1913)?

104. Are there any minerals that are essential for industries of Imperial importance that ought to be developed at public expense? (*E.g.*, minerals of direct importance for the manufacture of munitions of war, or minerals ordinarily obtained in commerce from one country only.)

Forest Department.

105. From the point of view of industrial enterprise, have you any criticisms to make regarding the policy and working of the Forest Department?

What suggestions do you make?

106. What measures are practicable to reduce the cost of assembling raw forest products?

107. To what extent is it practicable to concentrate special kinds of trees in limited areas?

108. What noticeable deficiencies in forest transport are known to you?

What suggestions do you make for their removal?

109. Have you any complaints to make regarding competition by jail industries?

X.—General.

110. What suggestions have you to make for the development of any industry in which you have been actively concerned or interested?

111. Does your experience suggest to you any new industry for which India seems peculiarly suited on account of its resources in raw materials, labour and market?

112. What supplies of raw materials are known to you of which the use in industry or trade is retarded by preventible causes?

What are these causes, and how should they be removed?

112 (*a*). Have you any suggestions to make regarding the utilization of waste from raw materials?

112 (*b*). Have you any suggestions to make regarding Government aid in the improvement of raw material, such as, cotton, silk, sugarcane, etc.?

112 (*c*). What industries in the country are dependent on the importation of raw materials and partly manufactured articles from abroad?

113. Do you know of any supplies of raw materials for which there is a good case for investigation with a view to their development?

APPENDIX—A-4.

ITINERARY OF THE PRESIDENT'S MONSOON TOUR 1916.

1916—

June 30th	Departed	Simla.
July 2nd to 13th	Halted	Calcutta.
„ 14th to 16th	„	Ranchi.
„ 17th to 19th	„	Sakchi.
„ 20th and 21st	„	Calcutta.
„ 22nd to 24th	„	Kulti with a visit to Asansol.
„ 25th and 26th	„	Calcutta.
„ 28th to August 4th	„	Madras with visits to Nellikuppam and Cuddalore.
August 5th and 6th	„	Coimbatore.
„ 7th and 8th	„	Ootacamund.
„ 9th to 15th	„	Bangalore with a visit to Oorgaum.
„ 17th to 24th	„	Bombay.
„ 25th to September 3rd	„	Nagpur.
September 4th to 8th	„	Jubbulpore with a visit to Katni.
„ 9th	„	Maihar.
„ 10th	„	Allahabad.
„ 11th to 15th	„	Naini Tal.
„ 16th and 17th	„	Dehra Dun.
„ 18th to 20th	„	Cawnpore.
„ 21st	Returned	Simla.

ITINERARY FOR THE YEAR 1916-17 (FIRST TOUR OF COMMISSION).

1916—

October 27th	Assembled at Delhi	Mr. Low was absent October 27th—November 16th.
„ 27th to November 1st.	Halted Delhi.	
November 2nd	„ Dehra Dun.	
„ 3rd	„ Bareilly.	
„ 4th and 5th	„ Lucknow	Pandit Malaviya was absent November 5th—7th.
„ 6th to 12th	„ Cawnpore	Pandit Malaviya was absent November 12th—17th. Sir D. Tata was absent November 10th—30th.
„ 13th	„ Agra.	Sir F. Currimbhoy was absent November 13th—26th.
„ 14th	„ Firozabad.	
„ 15th	„ Benares.	
„ 16th to 20th	„ Bankipore.	
„ 21st to 26th	„ Muzaffarpur with a visit to Pusa.	
„ 27th to December 13th.	„ Calcutta.	
December 14th to 20th	„ Nagpur with a visit to Katni.	Sir F. Currimbhoy was absent December 17th—24th. Pandit Malaviya was absent December 17th—24th. Sir F. Stewart was absent December 14th—23rd. Sir D. Tata was absent December 17th—24th.
„ 21st to 23rd	„ Jubbulpore.	
„ 24th to January 5th, 1917.	„ Calcutta.	

1917—

January 6th	„ Kulti	Sir F. Stewart was absent January 6th—8th.
„ 7th and 8th	„ Sakchi.	
„ 9th to 19th	„ Calcutta	Sir D. Tata was absent January 19th—28th.
„ 21st to 31st	„ Madras	Sir T. Holland was absent January 29th—February 14th.
February 1st to 3rd	„ Calicut	Dr. Hopkinson was absent February 1st—3rd.
„ 4th to 8th	„ Coimbatore	Pandit Malaviya was absent February 4th—14th.
„ 9th to 14th	„ Bangalore.	
„ 17th to 20th	„ Delhi.	

Subsequently went into recess.

ITINERARY FOR THE YEAR 1917-18 (SECOND TOUR OF COMMISSION)

1917—		
November 7th	Assembled at Bombay.	
,, 7th to December 4th.	Halted Bombay	Sir T. Holland was absent December 2nd—24th. Mr. Chatterton was absent November 28th—December 24th. Pandit Malaviya was absent November 7th—December 10th. Sir R. Mookerjee was absent December 1st—9th.
December 6th to 15th	,, Lahore.	
,, 16th and 17th	,, Lyallpur with a visit to Gojra.	
,, 18th and 19th	,, Rasul	Pandit Malaviya was absent December 18th—22nd.
,, 20th to 22nd	,, Amritsar with a visit to Dhariwal.	
,, 24th to January 3rd, 1918.	,, Calcutta	Sir T. Holland, Sir F. Currimbhoy and Sir D. Tata were absent January 3rd.
1918—		
January 4th to 8th	,, Gauhati	Sir T. Holland, Sir F. Currimbhoy, and Pandit Malaviya did not take part in Assam or Burma tours. Sir D. Tata did not take part in Assam tour.
,, 9th and 10th	,, Shillong.	
,, 12th to 18th	,, Calcutta.	
,, 21st ,, 26th	,, Rangoon.	
,, 28th and 29th	,, Namtu with a visit to the Bawdwin Mine.	Sir D. Tata was absent January 28th—29th.
,, 31st to February 1st	,, Mandalay.	
February 2nd	,, Nyaungu.	
,, 3rd	,, Singu.	
,, 4th	,, Yenangyaung.	
,, 5th	,, Allanmyo.	
,, 6th	,, Prome.	
,, 7th and 8th	,, Rangoon.	
,, 12th to April 6th	,, Calcutta	After February 14th the Commission went into recess. The Members met March 18th—29th to consider the draft report, with the exception of Sir T. Holland who was unable to be present. Mr. Chatterton was absent March 24th—29th and Pandit Malaviya March 18th—21st.
April 8th	Arrived Simla.	

LIST OF INSPECTIONS (1916-17 TOUR).

Date of inspection.	*Name of place visited or inspected.*
October 1916—	
26th	Delhi Biscuit Factory.
28th	The Art Industries of Delhi.
November 1916—	
2nd	Forest Research Institute, Dehra Dun. Thymol Factory of the Dixon Chemical Company, Dehra Dun.
3rd	Match Factory, Bareilly. Furniture Workshops, Bareilly. Government Carpentry School, Bareilly.
4th	Upper India Paper Mills, Lucknow. School of Arts and Crafts, Lucknow. Mechanical Engineering School, Lucknow.
7th	Cawnpore Woollen Mills.
8th	Brushware, Limited, Cawnpore. Elgin Mills, Cawnpore.
9th	Messrs. Cooper Allen and Company, Limited, Cawnpore.
10th	Government Harness Factory, Cawnpore.
11th	Village Settlements, Cawnpore.
12th	Cawnpore Sugar Works, Limited.
13th	John's Flour Mills, Agra
14th	Glass Works at Firozabad.
15th	Government Weaving School, Benares.
16th	Bihar School of Engineering, Bankipore.
22nd	Japaha Sugar Company, Muzaffarpur.
23rd	Agricultural Research Institute, Pusa.
24th	Bose's Cutlery Factory, Muzaffarpur. Bengal Preserving Company, Muzaffarpur.
25th	Saltpetre Refinery, Muzaffarpur.
29th	Titaghur Paper Mills. Titaghur Jute Mills.
30th	Calcutta Pottery Works.
December 1916—	
2nd	Sibpur Civil Engineering College.
4th	Calcutta Port.

LIST OF INSPECTIONS (1916-17 TOUR)—*contd.*

Date of inspection.	*Name of place visited or inspected.*
December 1916—concld.	
5th	Pen and Pencil Factory of Messrs. F. N. Gooptu and Company, Calcutta.
6th	Messrs. Jessop and Company's Iron Works, Howrah.
12th	Bengal National Tannery, Calcutta.
15th	School of Handicrafts, Nagpur.
20th	Cement Works, Katni.
21st	Pottery Works of Messrs. Burn and Company, Jubbulpore.
22nd	Gun Carriage Factory, Jubbulpore.
January 1917—	
6th	Bengal Iron and Steel Company's Works, Kulti. Kumardhubi Engineering Works, Limited (Bird and Company). Kumardhubi Fireclay and Silica Works, Barakar.
7th and 8th	Tata Iron and Steel Company, Sakchi.
12th	Workshops of Messrs. Burn and Company, Howrah.
13th	Messrs. D. Waldie and Company and the Bengal Distilleries, Limited, Konnagar. Government Central Weaving Institute, Serampore.
15th	Ordnance Factories, Cossipore and Ishapur.
23rd . . .	Buckingham and Carnatic Mills, Madras.
25th	Chrome Leather Company's Tannery, Pallavaram..
26th	Indian Aluminium Company, Madras.
27th	Harbour Works, Madras.
February 1917—	
1st . .	Henke's Tile Works, Feroke, Malabar. Government Fish Canning Station, Beypore.
3rd . .	Cocoanut Oil Mill, Calicut. Coir Weaving Shed, Calicut. Basel Mission Weaving Establishment, Calicut. New Malabar Timber Yards, Calicut. Government Soap Factory, Calicut.
5th	Agricultural College, Coimbatore.
8th	Singanallur Jaggery Factory (near Coimbatore).
11th	Sandalwood Oil Factory, Bangalore.
12th .	Kolar Gold Fields.
13th	Indian Institute of Science, Bangalore. Steam Jaggery Boiling Plant, Agaram

LIST OF INSPECTIONS (1917-18 TOUR).

Date of inspection.	*Name of place visited or inspected.*
November 1917—	
14th	Bombay Harbour.
17th	Great Indian Peninsula Railway Carriage and Wagon Workshops, Matunga.
19th	J. J. School of Art, Bombay.
20th	Victoria Jubilee Technical Institute, Bombay.
21st	Bombay Medical Stores Depôt.
22nd	Inspection of Chawls, Bombay.
24th	Tata Hydro-electric Works.
27th	Royal Indian Marine Dockyard, Bombay.
28th	Sydenham College of Commerce, Bombay. Bombay Swadeshi Stores.
29th	Queen Mary Technical School for disabled Indian Soldiers, Bombay.
December 1917—	
9th	Government Rosin and Turpentine Factory, Jallo.
11th	North-Western Railway Workshops, Lahore. Railway Technical Institute, Lahore. Hindu Technical School, Lahore.
14th	Government Central Weavery, Lah
15th	Mayo School of Art, Lahore. Central Jail and Borstal Jail, Lahore
16th	Cotton Market, Gojra.
17th	Agricultural College, Lyallpur. Wheat Elevator, Lyallpur.
18th	Salt Mines, Khewra.
19th	Engineering College, Rasul. Head Works of Lower Jhelum Canal. Upper Jhelum Canal.
20th	Hydro-electric Works and Pumping Scheme, Amritsar.
21st	Criminal Tribes Settlement, Dhariwal. New Egerton Woollen Mills, Dhariwal. Borstal Jail, Dhariwal.
22nd	Ghulam Sadiq's Carpet Factory, Amritsar. Municipal Technical School, Amritsar.

LIST OF INSPECTIONS (1917-18 TOUR)—*concld.*

Date of inspection.	*Name of place visited or inspected.*
January 1918—	
6th	Silk-Weaving Village of Sualkuchi.
10th	Experimental Fruit Station, Shillong.
22nd	Arts Exhibition, Rangoon.
23rd	Teak Yards and Saw Mills of the Bombay-Burma Trading Company, Limited, Rangoon.
24th	Messrs. Steel Brothers' Rice Mill at Pazundaung.
25th	Burma Oil Company's Refineries at Syriam.
28th	Namtu Smelters.
29th	Bawdwin Mine.
31st	Irrawaddy Match Company, Mandalay.
February 1918—	
1st	Saunders' Weaving Institute, Amarapura.
2nd	Lacquer Workers at Nyaungu.
3rd	Oil fields, Singu.
4th	Oil fields at Yenangyaung—Drilling and Pumping station.
5th	Jamal's Cotton and Produce Company, Limited, Allanmyo.
6th	Hand-loom Weaving at Shwedaung.
7th	Government School of Engineering and Technical High School, Insein.
28th	Calcutta Technical Evening School.
March 1918—	
11th	East Indian Railway Locomotive Workshops, Jamalpur.

APPENDIX B.

DRAFT NOTE ON THE INDUSTRIAL ASPECT OF COTTON GROWING IN INDIA.

The world position.

The first point for consideration is the possible increase of the outturn of Indian cotton. The figures below, which are taken from Professor Todd's book "The World's Cotton Crops" (pages 395, 410), will show the world position.

(Figures in 000's of 500 lbs bales.)

* Year.	1907-08.	1908-09.	1909-10.	1910-11.	1911-12.	1912-13.	1913-14.
Production .	18,640	22,271	20,536	22,829	26,186	26,044	27,703
Consumption .	21,053.	22,387	22,318	24,605	26,126	26,863	27,000

According to these estimates, the supply was as a rule in considerable deficit, but it is, at any rate, clear that there has thus been an actual shortage of cotton, which will tend to become more acute as the standard of comfort rises in the less civilised countries of the world. It seems a generally accepted view that much more cotton cloth could be sold, if greater supplies of cotton were available. In case of shortage, it is evident that Great Britain will be the chief sufferer. Her mills consumed 4,300,000 bales, of which 3,700,000 (500 lbs.) came from America, 400,000 from Egypt (720 lbs.), 50,000 from India (400 lbs.), and 150,000 from elsewhere. The mill consumption of the United States of America has followed the course shown below :—

Year.	000 bales.	Proportion of United States crop consumed by United States mills.
1911	4,301	35·6
1912	5,391	33·5
1913	5,389	38·2
1914	5,503	37·8
1915	6,088	40·3

The increase in the average United States crop for the above period over the period 1890-96 was 6,000,000 bales, of which increased consumption in the United States took 2,730,000 bales, and Continental increased consumption 2,630,000 bales, leaving only 640,000 bales for Great Britain.

The last year shows the highest percentage of any year except 1910; when the United States mills took over 40 per cent. of the very small crop of the year. It seems clear that the relative proportion of the crop taken by the local mills is bound to increase, and that any such increase will be at the expense of British spinners.

The latter have carefully examined the developments possible in different parts of the British Empire.

In comparison with Britain's African Colonies, India is a country with good communications, an intelligent agricultural population, and large areas under cotton. For these reasons, it has been held that in no other country can the requisite increase of the cotton crop be obtained so quickly. The matter is too urgent, from the point of view of the textile trade of the world, and especially of Great Britain, to admit of awaiting the results of work in so

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NOTE.—The Commission understands that a preliminary version of the above note, prepared in December 1916, was placed before the Secretary of State by the Government of India, and was taken into consideration by him when sanctioning the appointment of the Cotton Committee. This body has been enquiring into the various matters raised in this note, and the Commission therefore thinks it unnecessary to revise the draft note, which, however, it desires to place on record.

* Statement No. 1 appended shows further details and values.

difficult a country as tropical Africa. Admitting the need, it is hardly part of our duty to enquire if a case can be made out for bringing any pressure, other than the inducement of higher profits, to bear on the Indian ryot, in order to get him to increase the area under cotton. Indeed, even an increased price for cotton will tend to fail of effect by enhancing the price of food grains, if it raises the proportionate area under cotton beyond a very easily reached limit. If, on the other hand, the outturn of the existing cotton area can be increased, then the inducement to grow cotton will be the greater, while the world, including India, will get what it wants, namely, more cotton. There is no doubt a great deal of scope for improvement. The average yield for India is 98 lbs. of ginned cotton per acre ; while the figures for America and Egypt are 200 lbs. and 450 lbs., respectively.

It is agreed by various authorities that the average annual cumulative increase in the world's demand will be somewhere between 1,000,000 and 750,000 bales. An increase of 50 per cent. in the outturn of 6,000,000 bales, which may be taken as representing the present possibilities of India's crop, would satisfy this demand for three years. An increased outturn is perhaps the least difficult of the various agricultural problems connected with Indian cotton. Granted a research department to produce more prolific types, an organisation to introduce them, and an increased supply of fertilisers ; and the rest is merely a question of time. The progress that has been made along these lines will be discussed when we come to speak of the work that is being done in the different provinces. But the matter is further complicated by the low money value of most of the Indian crop, the demand of Indian spinners for a longer staple, and the generally expressed doubts of European spinners to what extent any increase in the Indian short-staple will really relieve the situation, and whether India herself is not incurring grave risks by continuing to rely so largely on a single type of staple.

Increase of yield and improvement of quality.

2. We may first consider then what should be the place assigned to the rival or rather complementary policies of increasing the yield of the indigenous short-staple cotton, which has been the most important feature in the work of more than one province hitherto, and of introducing longer-staple varieties. From an imperial point of view, it is perhaps unsatisfactory, that India should export the bulk of her surplus cotton to foreign countries, while England depends for her materials on America, or has to make desperate efforts to supplement them by supplies from her younger colonies and dependencies. An unsatisfactory feature of India's large export to foreign countries has been illustrated during the war by the fact that the initial German stocks of cotton for explosives had their origin in India, and that no inconsiderable amount of Indian cotton is made up in foreign countries and re-exported to India as manufactured goods to compete with those of her own production. On the other hand, the short-staple over a very large area gives the biggest profit to the cultivator, and will apparently continue to do so for some time to come. We have, however, to consider whether India's present position is satisfactory from her own point of view in view of future possibilities.

Professor Todd (The World's Cotton Crops—pp. 383-384) believes that, with a reduced acreage during the war, the demand for cotton when the war is over will be difficult to meet, the European nations that have suffered most from the war will be apt to use cotton in substitution for the more expensive textiles that they required previously, while eastern nations, who mainly wear cotton cloth, have been less affected by the war, and will need at least a normally increased quantity of cotton cloth. There seems nothing in post-war conditions that is likely to lead to a falling-off in the demand for cotton. There is some reason to believe that the area sown with cotton in the United

States of America is not likely to increase very rapidly in future. The growers have been led by the war to see more than ever the advantages of a more mixed system of cropping. Labour is getting scarcer in the Southern States, and its wages have risen very strikingly; and the spread of the boll-weevil has shown no signs of slackening. It may be added that the increased wealth brought into the United States of America by the war will probably lead to the construction of more mills and the local consumption of more of its own cotton. These factors, while increasing the demand for cotton generally, will tend to enhance the existing premium on long-staple cotton very considerably. The premium on Egyptian over American cotton rose as between the period 1894-98 and 1909-13 from 1·12*d.* to 3·45*d.*, per lb., or from 26 per cent. to 53 per cent.

Position of short-staple crop.

3. It is alleged by Professor Todd (p. 21) that many spinners, especially on the Continent of Europe, use rather longer-staple cotton than they really need to spin the counts which they produce. The more cotton that India can produce of a slightly better type, the more of the longer-staple that these mills at present use can be released for the use of spinners who really need it. If the above is correct, in view of the greatly increased competition for American cotton that the considerations adduced in the preceding paragraph indicate, the greater would be the advantage gained by this substitution. Sir Bezonji Dadabhoy, however, stated that no one uses any longer-staple than he needs at present. Before the war, India sold much of her short-staple cotton to European countries, and it is probable that this trade will revive, and even increase to some extent, as the replacement of wool by, or its admixture with, short-staple cotton is stimulated by invention, and by the desire to use a cheaper material than wool. On the other hand, the main direction of expansion of the cotton industry in India, as elsewhere, is sure to be towards the use of finer staples and higher counts, as the standard of comfort in the less civilised parts of the world rises.

Finally, as Japan is stimulating the growth of cotton, mostly of the American type, in Corea, so at no distant date circumstances may place her in a position to increase the cotton yield of China. The Chinese crop has hitherto been a very obscure factor, but is, it would seem, capable of indefinite expansion, with improved communications and a more settled system of Government. About 1¾ million bales are said to enter commercial channels, and much is consumed internally in addition. The yield was very recently stated by a member of the Japanese textile industry at 7,000,000 piculs, or 2¼ million bales, the area having increased owing to the replacement of opium by cotton in the Shensi Province. The bulk of it is of the Indian type, and whatever may be done—and much no doubt will be done—to improve the length of staple, there will be for long a large quantity of short-staple cotton available. Whether the exploitation of Chinese cotton will, in such circumstances, ever constitute a serious menace to the price which the Indian grower of short-staple cotton in India can command cannot be foreseen, but the risk is worth bearing in mind.

The "Japan Chronicle" of 18th January 1917 stated that in 1904 Japan imported 17,550,000 kwan of Indian and 15,300,000 kwan of Chinese cotton. Owing to the neglect of cotton cultivation in China, Japan drew a relatively larger proportion of her supplies from India, but if the quality of Chinese cotton is further improved, it will be able to meet about 70 per cent. of Japan's demands.

The Indian crop and its consumption.

4. The statement below shows the final estimates of areas under cotton in India for the years since 1907-08, together with the production, deduced

from the total of exports, mill consumption and estimates of extra-mill consumption :—

Year.	Area in 000 acres.	Outturn in 000 bales of 400 lbs.
1907-08	21,630	3,782
1908-09	19,999	4,200
1909-10	20,545	4,928
1910-11	22,596	4,303
1911-12	21,615	3,985
1912-13	22,028	4,483
1913-14	25,023	5,913
1914-15	24,595	4,889
1915-16	17,746	5,109
1916-17	21,212	4,760

India's crop in 1913-14 was valued at 81 crores of rupees or £54 million sterling, which was 15 per cent. of the value of the world's total crop in that year.

The statement below shows the countries to which and the quantities in which Indian cotton was exported from 1911-12 to 1915-16.

Country to which exported	1911-12	1912-13	1913-14	1914-15	1915-16
	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.
United Kingdom	418,012	805,545	384,914	707,779	883,628
Germany	890,516	950,199	1,688,070	1,239,472	...
Belgium	774,463	864,304	1,183,083	794,369	...
France	291,960	327,767	524,264	552,273	205,457
Spain	127,815	86,950	166,933	224,964	239,025
Italy	680,271	583,698	848,576	1,354,902	1,124,106
Austria-Hungary	471,580	396,452	747,041	585,735	...
China (exclusive of Hong-Kong and Macao)	48,097	118,007	84,707	146,026	296,664
Japan	3,514,651	3,591,768	4,817,560	4,454,931	5,917,663
Other Foreign Countries	40,539	56,296	105,735	169,504	140,238
Total Foreign Countries	6,839,892	6,975,441	10,115,969	9,522,176	7,923,153
Total British Empire (excluding United Kingdom).	70,619	96,526	125,429	119,090	97,186
GRAND TOTAL	7,328,523	7,377,512	10,626,312	10,349,045	8,853,967

5. The following statement shows the estimated areas of the various classes of staple during the year 1916-17 :—

Description of cotton.	Acres.
Oomras—	
Khandesh (Bombay)	1,423,000
Central India	1,411,000
Barsi and Nagar (Bombay)	3,436,000
Berar	3,118,000
Central Provinces	1,283,000
Total	10,671,000
Dholleras (Bombay)	2,046,000
Bengal—Sind—	
United Provinces	1,184,000
Rajputana	415,000
Sind-Punjab	1,430,000
Others	73,000
Total	3,102,000
Broach (Bombay)	1,230,000
Kumpta-Dharwars (Bombay)	1,097,000
Westerns and Northerns (Madras)	1,382,000
Cocanadas (Madras)	289,000
Tinnevelly (Madras)	707,000
Salems including Cambodias (Madras)	337,000
Comillas, Burmas, and other sorts	351,000
GRAND TOTAL	21,212,000

6. The following descriptions of the leading types of Indian cotton have been selected from the table on page 81-2 of Mr. Pearse's latest report:—

Broach	Very white, good staple and silky ⅞" to 1".
Kumpta and Saw-ginned Dharwar . .	Dull, yellowish and silky ⅝" to ⅞".
Dhollera	½" to ⅞".
Oomra	½" to ⅝", except Hinghanghats, which are up to 1".
Bengal	⅜" to ½".
Sind deshi	Like the last.
Tinnevelly (Karunganni) . . .	1".
Cambodia	1".

Westerns and Northerns ⅞" to 1". Northerns are rather reddish, Westerns fairly white. Both grow in North Madras.

Cocanadas ⅞", like Northerns, heavy yielder.

Further details can be found on pages 26-7 of Professor Todd's book.

Figures of prices for middling American and Indian cotton (No. 1 Oomras) and for exports of the latter go to show that when the difference rise, and especially if it exceeds or even approaches one penny, the exports of Indian cotton increase.

This fact also tends to support the view expressed above, that Indian cotton, especially if slightly improved, could replace some of the American cotton at present being consumed in the spinning of comparatively low counts.

Including as long-staple cottons those varieties that produce fibre of approximately 1" in length, we have from the last forecast—Broach 1,230,000 acres, Tinnevelly 707,000, Salems 337,000—total 2,274,000 acres. Some deduction must be made from this, on account of shorter-staple cotton produced in the tracts which have been taken above as long-staple areas. On the other hand, some addition must be made for long-staple cotton, like introduced varieties and Hinghanghats, which have been included among Bengals and Central Provinces types, as not considerable enough at present for separate, enumeration. No details are as yet available for outturn of the long-staple varieties, but reckoning 3 acres to the bale, which is considerably in excess of the average Indian yield of 98 lbs., the total yield is something like 400,000 bales of 400 lbs. The yield has been variously estimated by experts at from 350,000 to 500,000 bales. A considerable quantity of this is said to have gone to Japan, though this is denied by others.

Mr. Couchman in his Handbook of Commercial Information for Madras (pages 37-44) attempts a percentage estimate of the destinations of the leading types of cotton exported from that Presidency.

Tinnevellies.		Cocanadas.		Total Madras cottons.	
Country.	per cent.	Country.	per cent.	Country.	per cent.
Japan	36	Belgium . . .	35	Japan . . .	36·3
United Kingdom . .	25	Germany and Austria-Hungary . .	14	Belgium . . .	19
				United Kingdom .	17
Germany . . .	6	France . . .	13	Germany . . .	47
Italy	3·6	Italy . . .	12	Italy . . .	5·4
Austria-Hungary . .	...	United Kingdom .	11	Austria-Hungary	5·3
Belgium and China .	3	Japan . . .	9	France . . .	3·3

A consideration of the above table tends to support the view that Japan also requires longer-staple cotton,

7. The statement below shows the imports from abroad and the production by Indian mills of low, medium and high counts of yarn during the past five years:—

Statement comparing the imports of coarse, medium and fine yarns with the production of similar descriptions by the Indian mills.

Unit—1,000 lbs.		1910-11.		1911-12.		1912-13.		1913-14.		1914-15.		1915-16.	
			per cent.		per cent.		per cent.		per cent.		per cent.		per cent.
Nos. 1-25.	Imported . .	1,602	·3	1,549	·3	4,148	·7	2,150	·3	813	·1	1,338	·2
	Indian . .	553,948	99·7	565,199	99·7	623,834	99·3	616,688	99·7	590,829	99·9	660,688	99·8
	Total .	555,550	87·2	566,748	85·4	627,982	85·8	618,838	86·0	591,642	86·0	662,026	87·6
Nos. 26-40.	Imported . .	19,674	26·8	28,322	32·5	31,395	34·0	27,343	30·3	28,842	33·0	25,613	30·2
	Indian . .	53,743	73·2	58,924	67·5	60,989	66·0	62,711	69·7	58,447	67·0	59,123	69·8
	Total .	73,417	11·5	87,246	13·2	92,384	12·6	90,054	12·5	87·289	12·7	84,736	11·2
Above 40.	Imported . .	6,627	78·3	7,131	76·4	8,768	74·9	7,858	74·4	7,021	75·9	7,512	79·3
	Indian . .	1,840	21·7	2,199	23·6	2,938	25·1	2,698	25·6	2,233	24·	1,963	20·7
	Total .	8,467	1·3	9,330	1·4	11,706	1·6	10,556	1·5	9,254	1·3	9,475	1·2
	GRAND TOTAL .	637,434	100	663,324	100	732,072	100	719,448	100	688,185	100	756,237	100

There is very little European trade under the lowest counts for Indian mills to supplant; on the other hand, Japanese competition has recently become severe in respect of some of these descriptions. The greatest scope for the expansion of the Indian industry appears to exist under the medium and higher counts. To produce a staple suitable for counts above 40's, India would have to grow either a much higher grade American cotton than has been hitherto attempted on anything like a commercial scale, or an Egyptian cotton. The latter can certainly be grown in Sind, and perhaps in the Punjab and in Rajputana. It is stated that in the case of both the first and the last, irrigation would be needed on a far more ample scale than at present. Further enquiries will have to be made regarding the areas that can be made available for the higher classes of staple. For the present the figure for the Punjab and Sind may be provisionally placed at 3,500,000 acres. We have seen what looks like a much lower estimate, *viz.*, 350,000 acres in the Punjab within the next four years. The present area under American cotton in that province is 120,000 acres. Mr. Hailey (*vide* paragraph 8) puts the area available for American or other cotton requiring early irrigation at 500,000 acres. No information has yet been obtained for Bombay or Madras. The Central Provinces are not likely to be able to afford more than 100,000 acres for irrigated cotton.

With regard to the improvement of the indigenous staple, there is no doubt that any improvement in length, etc., while maintaining the hardiness, ginning percentage and outturn of the present type, would be a very great help. If the present cottons from which 10's are now spun could be improved so as to yield 15's or even 20's, the future of the Indian crop would be far more secure than it at present appears.

Work by Agricultural Department.

8. Having discussed the necessity for and the probable effects of:—

(*a*) an increase in the production of short-staple cotton

(*b*) the introduction of more long-staple cotton;

we may now examine the efforts which are being made in the chief cotton-growing provinces of India towards these ends. The statement in paragraph 5 above shows the areas under the main types of cotton in the different provinces. This is far from a complete classification by types and areas, but is a compromise between what is ideal and what is possible.

Speaking very generally, the present facts and future possibilities in the different provinces are exhibited in the statement below, and in the description which follows it of the position in the chief cotton-growing provinces.

The statement below indicates the area under cotton in each of the leading cotton-growing provinces of British India during each year since 1907-08 and the yield in bales. A reference to the table in paragraph 5 will show to some extent the types of cotton grown in each case.

Area in 000's of acres.
Yield in 000's of bales of 400 lbs.
Value in 000's of rupees.

Year.	...	Bombay and Native States.	Central Provinces and Berar.	Madras and Native States.	United Provinces.	Punjab and Native States.
1907-08 . . .	Area . . .	7,101	4,432	1,855	1,461	1,474
	Yield . . .	1,039	595	198	268	356
	Value . . .	9,80,39	5,26,95	1,93,70	2,12,52	2,76,68
1908-09 . . .	Area . .	6,241	4,176	1,576	1,392	1,562
	Yield . . .	1,282	766	162	426	324
	Value . . .	14,23,82	7,08,07	1,46,96	3,41,69	2,89,17
1909-10 . . .	Area . . .	6,469	4,167	1,569	1,241	1,436
	Yield . . .	1,661	1,070	180	384	396
	Value . . .	19,42,50	10,96,92	1,79,92	3,50,98	3,52,01
1910-11 . . .	Area . . .	7,334	4,487	1,873	1,347	1,385
	Yield . . .	1,450	629	335	348	306
	Value . . .	20,25,02	8,06,92	2,82,02	4,05,73	3,52,74
1911-12 . . .	Area . . .	5,786	4,648	2,878	921	1,582
	Yield . . .	695	913	335	251	241
	Value . . .	10,27,08	12,06,16	4,02,03	3,06,88	2,99,89
1912-13 . . .	Area . . .	6,826	4,493	2,414	1,158	1,575
	Yield . . .	1,520	910	471	428	378
	Value . . .	19,70,38	11,25,70	5,39,83	4,91,09	4,30,45
1913-14 . . .	Area . . .	7,323	4,754	2,725	1,586	2,053
	Yield . . .	1,614	961	808	484	612
	Value . . .	20,88,95	12,40,89	3,98,01	5,42,38	7,08,42
1914-15 . . .	Area . . .	7,796	4,708	2,115	1,551	1,857
	Yield . . .	1,773	1,097	245	486	486
	Value . . .	19,00,62	10,34,84	2,73,17	3,68,90	3,68,27
1915-16 . . .	Area . . .	4,439	4,061	2,061	834	902
	Yield . . .	934	1,106	245	262	195
	Value . . .	8,20,31	8,95,51	3,57,11	1,98,21	1,36,81

Bombay.

Bombay contains a large area, especially in the Deccan, under short-staple, that can probably be extended, though not to a very large extent. In Dharwar, there is a considerable area under an American type known as Dharwar-American, that was introduced at the time of the American war. Another long-stapled cotton is grown here, known as Kumpta. Broach and Cambodia have also been introduced, but circumstances do not seem to be entirely favourable for them, and these varieties, though they may continue to be grown in small areas, are said not to be likely to spread widely. More is to be hoped from the further improvement of the existing Kumpta variety, the weak point of which is its low ginning percentage. In Gujerat cotton covers a large area, but over much of the north of the Gujerat division short-staple cotton is found. Attempts are being made to introduce a longer-staple variety, by selection from the local varieties.

The statement below supplied demi-officially by Mr. Keatinge, Director of Agriculture, Bombay, explains the general position in that Presidency :—

Area.	Type.	Length of staple in ⅛".	Ginning percentage.	Price on January 8th, 1916.
N. Gujerat	Navsari . . .	8—9	31	+ Rs. 25 on Surat.
	Surat . . .	6—8	32	+ Rs. 15 on Broach.
	Broach . . .	6	34	Rs. 410 (Good.)
S. Gujerat	Lalio . . .	7	31—32	
	Waghad . . .	6	32	
	Mathio . . .	4	33 – 34	
Deccan	Khandesh . .	4	34—35	
Southern Maratha Country.	Kumpta . . .	7—8	25	
	Dharwar-American .	6	31	
Sind . . .	Sindi . . .	4	33	

Khandesh is a mixture, Mathio is identical with Khandesh, recently introduced into north Gujerat and rapidly spreading. Ghoghari, a short-staple variety with a high ginning percentage is beginning to spread in south Gujerat.

In Sind, the indigenous variety is short in staple, though a free yielder under the very indifferent cultivation that the local farmer affects. An attempt was made in the first instance to introduce an Egyptian type, but, though Sind can undoubtedly grow Egyptian cotton, for her to do so on a large scale and with reasonable certainty from the cultivator's point of view, a better system of cultivation will have to be introduced, and a more permanent source of irrigation will be necessary, for which extensive works on the Indus will be required.

The last report of the Imperial Cotton Specialist gives the following values for certain types recently introduced into different parts of Bombay. Dharwar Broach, with a ginning percentage of 32-33, can spin up to 40's and was priced at Rs. 375. Dharwar-Americans can spin 20's. Cambodias were valued at the Gadag auction at Rs. 320, and could spin 20's. This was on the following market basis: —

	Rs.
Sind-American	310
Madras-Cambodia	365
Navsari (Broach)	375
Superfine Bengal	250
Cambodia	340
Saw-ginned Dharwar	320
Kumpta	345

The price of Broach (good) is usually about 8 per cent. less than that of Americans (mid) but varied in the year before the war from 4 to 24 per cent. lower.

Central Provinces.

In the Central Provinces, there is a large area of short-staple cotton grown in the west and north of the province, which could no doubt be materially increased, and might perhaps be improved, but the main hope of introducing a long-staple cotton lies (1) in the light-soil areas now coming under irrigation, which, as the irrigation is in all cases by storage works, can never be very extensive, and (2) in the tracts with a rainfall somewhat higher than those hitherto regarded as most suitable for cotton in this province; here Cambodia may possibly give more profit than the short-staple.

It must not be forgotten that the length of the indigenous staple in this province has steadily declined since its cotton began to be exported. The old Berar Jari, which, it is said, would spin 15's or even 20's, has been replaced by a mixture of some six types, in which the types which mainly constituted the original Jari have tended to become less predominant, and the shorter-staple but more freely yielding types to form an increasing proportion of the mixture. This inferior mixture has also gradually spread over more and more of the area which was occupied by the superior but less prolific Bani. The operations of the Agricultural Department, which were necessarily and rightly directed towards increasing the cash yield per acre for the ryot, without consideration to the requirements of the industry, Indian or British, further added to this deterioration of quality. The most prolific variety, both in respect of yield and of ginning percentage, of the Berar mixture was found to be Roseum. This was selected for distribution, and with such success, that not less than 700,000 acres were placed under this type in 1916-17. The cash benefit to the ryot has been very great, amounting to something over a crore of rupees per annum over and above the value of the ordinary local mixture. The subject will be dealt with in further detail below, but is only mentioned here as an illustration of the fact that in the case of the varieties that can be grown at present in the cotton-producing tracts of most provinces of India the premium offered for length of staple is utterly inadequate to overcome the great difference in yield and ginning percentage between such types as the short-stapled, prolific Roseum and the long-stapled, but poorly yielding Bani. The notes of Professor Gammie, Imperial Cotton Specialist, on certain attempts which have been made in the Central Provinces to evolve a superior type, by crossing a short and a long-staple cotton, contain certain figures for the cash yield per acre of different types, and for the valuation of the new crosses as compared with existing varieties, which emphasize the above principle very strongly.

Type.	Counts.	Price. Rupees.
Bani x Roseum	20's to 22's	285
Bani x Deshi Lahore	?	295

The implication in the report is to the effect that the latter type is capable of spinning at least as high a count as the former; it has a ginning percentage of 35·5, and under the somewhat exceptional conditions under which it was grown, was a very free yielder. No definite comparison can yet be made in point of cash return between this and the local Roseum at present.

The figures below, received from Professor Gammie, are hardly encouraging:—

Species.	Yield per acre in cash. Rupees.
Cutchicum	104
Roseum	100
Bani	76
Berar Jari	74
Bani x Deshi Lahore	75

These prices sufficiently indicate, too, the reason why low-yielding long-staples like Bani and comparatively superior mixtures like Berar Jari are being rapidly replaced, in Berar and other parts of India, by free-yielding, high-ginning, short-staple varieties.

The above prices were on the following market basis:—

Variety.	Price in Rupees.
Cambodia	350
Ghat Bani	340
Fine Akola	265
Fine Khandesh	250
Indore	280
Fine Bengal	228
Superfine Bengal	240

The above basis prices also afford an indication of the relative values of the indigenous short-staple types as compared with an exotic like Cambodia.

Madras.

In Madras, there is first the long-staple Karunganni grown in Tinnevelly, till recently very largely mixed with Uppam. Efforts are being made to separate the two in order to secure a higher price for the Karunganni. Cambodia was also introduced into the same tract some years ago, and experience has shown that it can undoubtedly be grown at a profit, the yield for 1911 being estimated at 45,000 bales. The usual troubles, however, set in, owing to deterioration of that part of the crop sown on inferior lands and to adulteration. A very prolific cotton, locally called Pulichai, identical in type with the variety known as Roseum grown in Berar and Khandesh, came in a few years ago from the Deccan. Efforts have been made to stamp this out, as purely parasitic and owing its present apparent value to its use as an adulterant for the better local varieties; when it kills the value of these, as it is likely to do, unless arrested, the ryot will be left with a less profitable crop than the finer existing varieties.

In the Ceded Districts, the state of affairs is not dissimilar to that prevailing in Berar and Khandesh, and the agricultural part of the problem is being dealt with on very similar lines.

The United Provinces.

The prevailing type in the United Provinces is a short-staple cotton, which ripens early and is known to the trade as Bengals.

The position here is described by Mr. Hailey, Director of Agriculture, as follows:—" The first endeavours to improve cotton growing in the United Provinces were in the direction of introducing a long-staple cotton of American origin. The experiments began as early as 1881, but it was not until 1906 that the seed, which was then acclimatised but was of a mixed character, was distributed to cultivators in the Aligarh district. It is unnecessary here to allude to the difficulties of selling small quantities of any new type of cotton. The middlemen buy on the ginning percentage and have not been accustomed to differentiate in favour of quality. They would therefore give less for a long-staple *kapas* (seed cotton), which has a ginning percentage of 30 per cent. as compared with ordinary *deshi* with a percentage of 33 per cent. The manufacturer is not accustomed to buy *kapas* and wants the lint ginned and baled. In the absence of any other agency, it was necessary for the Agricultural Department to buy in the *kapas*, gin it, and sell to manufacturers. The cultivators were promised a bonus of Re. 1 per maund of *kapas* over the current price of *deshi*, and the lint was sold by auction. This arrangement also permitted the department to maintain purity of the seed and prevent any admixture of *deshi* seed.

"It worked well enough for three years and the cultivators usually received a bonus above the stipulated premium. But it was necessary to take an advance from Government to finance the operation, and in 1909, in consequence of the issue of orders by the then Secretary of State, the Government of India objected to the advance on the ground that it was a matter for private enterprise. As the cultivators would not sow without a guarantee from the department and no private firm would come forward to finance the undertaking, it collapsed and no more seed was distributed.

"As progress in the direction of improving the quality of the cotton seemed barred, the attention of the officers of the department was directed to improving the outturn. With this object Dr. Parr at Aligarh isolated a strain of *deshi* with a very heavy yield and a high ginning percentage of 39 to 40. It is characterised by a white flower and is known as the Aligarh white-flowered cotton. The staple is coarse and short, but the plant is hardy and a vigorous grower. In a short time it became very popular, since the buyer differentiated in its favour on account of the high ginning percentage. It is not possible to give the area under this crop, as the whole area under cotton has fluctuated so greatly of recent years, but it does not probably fall short of a lakh and a half of acres, and all the seed which the department can supply is readily bought up. Unquestionably, however, the lint is inferior to that of yellow-flowered *deshi*, and the department has always accepted the fact that, if the tide sets in steadily in the direction of better stapled cotton, a substitute must be found for this.

"Mr. Leake's hybridising experiments are directed towards this end. American cotton must be sown early and this needs irrigation. At the outside limit, the canals of these provinces could not supply water for irrigating cotton over more than 500,000 acres. The total cotton area is anything from a million to a million and a half acres, according to seasons and prices, and, therefore there is a very big area which must always be devoted to a cotton grown in the rains. Mr. Leake's crosses are of *deshi* varieties and can be grown on this unirrigated tract. At present it is sufficient to say that trials are being made on a field scale of several varieties with an appreciably better lint than *deshi*.

"I will now turn to the revival of long-staple cotton growing. In 1912 the Elgin mills offered to finance the growing of American cotton on the basis of a premium to the cultivators of Rs. 1-4 per maund (100 lbs.) of *kapas* After this, arrangements were to be made on the basis of spot price of middling American. In the first year the crop amounted to 120 bales. From that time to the present the lint has always been sold to one or other of the Cawnpore mills, at prices which give a premium of well over one rupee per maund of *kapas* to the grower, and in 1915 amounted to Rs. 2. The department, by an arrangement with a ginning factory, gins the whole crop in a single factory, paying the cultivators as they bring in the *kapas*. The purity of the seed is thereby maintained and the shorter strains are being gradually eliminated, For the last two years the Muir Mills have taken the whole. The crop has suffered owing to a great slump in prices in 1914 and two very wet years in 1915 and 1916, during which part of it was destroyed. It has consequently not spread very rapidly. The American cotton yields somewhat more heavily than *deshi* in ordinary years, but is more susceptible to water-logging and heavy rains. Further there has been a very great increase in the area under indigo, which has usurped part of the best cotton-growing land.

"In estimating the relative advantages to the grower of American and *deshi* cotton there are certain points to be borne in mind.

(*a*) The ginning percentage of Cawnpore-American is not more than about 31 per cent., while, as pointed out above, that of Aligarh white-flowered does not fall below 39 per cent. Consequently this defect must be made good by an appreciably higher price for the lint.

(*b*) American cotton must be sown before the rains and, therefore, on irrigated land for which canal rates have to be paid. The great bulk of *deshi* is sown in the rains.

(*c*) *Deshi* cotton is the earlier crop, and the cultivators in these provinces are in the habit of taking it up in October and sowing a *rabi* crop, such as peas mixed with barley, after it. American is longer on the ground and if a second crop is sown, late pickings cannot be taken.

"Though American cotton is sown at a time when the cultivator is ordinarily free from other work—and this constitutes its great advantage—yet it requires more care than *deshi*, and is subject to certain insect attacks, such as the leaf roller, which are of little importance in case of *deshi*. Again, American does not do well on poor soils, whereas *deshi* is often grown on the poorest lands in the village.

" Were there any great disparity of prices between the two crops, these disadvantages would fall into the background ; but the prices of *deshi* have remained, except in 1914, extraordinarily good, and the demand appears to be showing no falling-off. It is most difficult to strike any balance of profit between two crops—there are so many factors to take into consideration. But it would certainly be dangerous to pronounce definitely in favour of American cotton at the premia so far obtained. It suits certain cultivators to sow their cotton early and leave themselves free for rains sowings. Others want a second crop for food purposes and prefer the shorter growing *deshi*. If there is no great difference between two crops, a backward class of cultivator will choose the hardiest, safest and cheapest crop to grow—and he is probably from his point of view amply justified."

On the same market basis as that used by Professor Gammie for Bombay (*vide* page 9), Cawnpore-Americans were valued as follows :—

Number of type.	Can spin counts.	Value. Rs.
2	30's	340
9	24's	330
1, 6, 7, and 8	20's	325
Others	16's	310

The last report of the Agricultural Department of the United Provinces contains complaints that distribution of seed was carried on under difficulties, owing to lack of subordinate staff. The smallness of the average holding rendered it a matter of difficulty to discover suitable places for private seed farms. Co-operative societies, which appear to be ordinary credit societies and not co-operative unions organised *ad hoc*, are beginning to take up the work of seed distribution, and will, it may be hoped, relieve departmental officers to some extent of this task.

The Punjab. The Punjab probably offers the most immediately remunerative field for the dissemination of long-staple cotton of the American type. We are obtaining further information on the subject, but we have seen a statement to the effect that a single grower last year obtained an all-round yield of 250 lbs. of lint over an area of the same number of acres. More will be said below about the marketing problem in the Punjab and we shall have to obtain information regarding the land and irrigation water available for cotton growing, and in particular as to the truth of a statement, that the cotton area can be increased, if the cultivators will consent to reduce the area they sow with cold-weather irrigation; and how far such a practice is desirable, if possible. The fear of encroachment by the cotton crop on the area required by food grains is less acute in the case of the Punjab than elsewhere, seeing that only a small proportion of any particular area, which has been variously stated at one-tenth and one-sixth, can, it is alleged, be advantageously placed under cotton in any single year. A proposal was put forward by the British Cotton Growing Association some years ago, revived again by the International Cotton Spinners Federation more recently, but held in abeyance on account of the war, to take up an area in one of the canal colonies, erect gins, and demonstrate how Indian cotton can be grown and prepared for market under optimum conditions, and the grower brought into direct touch with world prices. This scheme should be examined by the Commission when they visit the Punjab.

Problem of introducing a superior type.

9. The position has now been discussed in sufficient local detail to indicate the nature of the problems before the Agricultural Department, the farmer and the trade. In the first place stands the desirability of improving the lint of the existing short-staple varieties, while maintaining the yield. This is no doubt a harder problem than that of introducing longer-staple varieties from outside; its results are likely to be very gradual in showing themselves; it involves the introduction of a cross which is capable of fertilisation by the remaining local species from which it has been built up; but it is not the less important of the two problems. The only province where this policy has been pursued steadily and consistently is the United Provinces. Some work has been done on these lines in the Central Provinces, where various crosses with the indigenous type have been produced. The work has, however not formed part of the regular programme of the Economic Botanist, but has been carried on by the Deputy Director of the Southern Circle. In view of the highly technical character of the research problems involved, this is certainly the duty of a botanist, and should be taken over by him. A much more general and sustained effort is needed for the solution of this problem than has been made hitherto, outside the United Provinces.

The short-staple crop is of great importance in the Central Provinces and Bombay, and to a less extent in Madras and the United Provinces. The Economic Botanists of these provinces have their hands already fully occupied with other work; and there would be ample employment for at any rate another botanist in each of the first two provinces for the study of this single problem. An increase of under a penny a pound in the value of the cotton produced in the 14,000,000 acres which grow the short-staple crop at present, would yield over 6 crores of rupees, justifying amply the immediate expenditure proposed.

We now turn to the consideration of the next problem, *viz.*, the introduction of a long-staple type, whether exotic or built up by crossing. In order to make the substitution as rapid as possible, and to obtain the advantage of a uniform type, some organisation for securing the distribution of seed true to type on a wide scale, at the minimum of cost and with the greatest probability of becoming a permanent local institution, is necessary. Such an organisation is undoubtedly to be found in the co-operative system of seed distribution. Under this system as worked in Berar, the Government farm distributes as much of the required seed as it can grow to central farms, attached to co-operative unions, but inspected by Government agency. These farms sow that seed, and distribute the seed in the second year to the seed farms of private individuals, members of the union, who grow it and sell it to the public in the third year. Where necessary, each union gins its own cotton, thereby ensuring the purity of the seed, which is apt to deteriorate and is liable to adulteration in ordinary commercial gins. The seed farms of the private members are inspected by an agency employed by the union, but trained and supervised by the Agricultural Department. Funds are found by members contributing to their unions from the profits they make by the sale of the improved seed at a rate higher than the bazaar rate. The extent to which seed distribution can be extended by this agency, when no other difficulties supervene, may be judged by the fact that in the Central Provinces an area of 700,000 acres was estimated to have been sown by this means during the year 1916-17. To increase the yield of an existing type, by the dissemination of a variant of the same type, yielding more seed cotton (as opposed to lint or ginned cotton), is easy. Adulteration is not a serious drawback, especially when, as in Berar, the cotton which it is sought to introduce is a specially short staple variety, which is proof against adulteration, owing to its low quality.

10. The next degree of difficulty is reached when the main advantage lies not in an increased gross yield of seed cotton, but in an increased yield of ginned cotton. The difference is not, however, one of kind, but of degree. The damage wrought by admixture is still small, and only the most short-sighted purchaser would attempt to snatch a transitory profit by refusing to pay prices based on the larger yield of lint. In a tract where, as is almost everywhere the case in India, gins abound, this refusal is not likely to be effective for long, and can in any case be overcome by departmental or co-operative ginning.

11. The real difficulty, however, arises, when the advantage in growing a new type lies not in quantity but in quality, such as strength, softness, colour or length of fibre. In the first place stands the necessity of securing improved cultivation. Apart from this, however, the difference in price is seldom marked enough to appeal to the grower, unless an absolutely pure strain of seed is obtained by him, and an absolutely unmixed yield marketed by or for him. Any admixture of a cheaper variety is fatal to price. At the same time, the existence of a superior type encourages an inferior type as an adulterant (as was shown above in the case of Pulichai in Madras), which will eventually kill the superior type, owing to the fact that its presence in increasing proportion lowers the price very rapidly, so that eventually it is not worth the grower's while to grow the superior type, since the reputation of the local name goes down, and he cannot get more for the pure than for the mixed variety.

Various means have been adopted in order to resist this evil, which arises in one form or another in every part of India where an improved variety has reached the position of a commercial crop.

Pure seed, as has been shown above, can always be supplied on a moderately large scale by a Government agency, and distributed through a certain number of private seed farms, supervised by a departmental agency, so long as some profit can be guaranteed to the grower, by a higher price either for his seed or his lint. Guarantees to this effect are often given by Government to start with, and were found necessary even in Berar at first.

The evil effect of gins in causing seed mixture, though real enough, can be combated by special arrangements. These arrangements, however, when the production reaches any considerable figure, impose a heavy burden on the expert agency, which is undesirable; while the gins are also in many cases the worst offenders in the matter of lint adulteration. To meet these difficulties it has been suggested that a system of licensing gins should be set up, by which they would be compelled to keep the seed and lint of certain types of cotton unmixed, under penalty of forfeiture or suspension of license. This is a point on which evidence is desirable in Bombay and the Punjab. It seems hardly necessary to carry legislative interference beyond the gin-owner, although the case must be provided for when the cultivator or dealer brings a mixed lot of cotton to the gin. The next difficulty lies in getting the pure cotton into the hands of the buyer, whether ginner or merchant, and in obtaining the maximum value from him. In Madras arrangements have been made for ryots to sell improved Karunganni on joint account direct to ginning firms. A scheme has also been worked with some success by a league of the principal buyers with the Agricultural Department, who refuse to purchase cotton which contains any admixture of the inferior Pulichai. This latter device is no doubt likely to be effective in cases where an obnoxious newcomer can be stamped out in a short campaign of a year or two.

The history of the work in Bombay is most instructive. Broach cotton introduced into Dharwar is being sold by auction after departmental grading. Obviously this action cannot be very widely extended by a departmental agency on the existing scale. In lower Gujerat, where an attempt was being made to improve the quality of the lint, a syndicate formed by Bombay mill-owners undertook to pay 5 per cent. above the prevailing rate for the improved Broach cotton with a higher ginning percentage. (It is desirable to enquire if this rate was fair.) As soon, however, as the area sown became considerable, difficulties arose which led to a breakdown of the scheme. There was a doubt as to what the local prices were. Local buyers offered higher prices for the improved cotton, and the syndicate were called on to pay their increment on the prices so enhanced. The ryots also rigged the market, or at any rate reported sales which were believed to be fictitious. Cultivators brought in their cotton when prices were high, and held it back when they fell. During the second year of operations, there was a steady fall in prices, and the ryots who held back their cotton, got lower prices in the end; the loss so incurred seems to have been associated in their mind, quite unfairly, with the operations of the syndicate. Further, the cotton bought up-country by the syndicate was reported to have been received in Bombay in an adulterated condition. The information at our disposal regarding the extent to which the syndicate bought direct, and through what agency, and the methods adopted by the Agricultural Department to secure that the cotton came forward in a pure condition, is not sufficient to show how this happened. In Sind, the syndicate erected saw gins, as the local roller gins were not suitable for dealing with the American type. The Deputy Director thought that the syndicate should have secured a larger proportion of the crop produced. There were also difficulties arising from inferior methods of cultivation, failure of canal water, and shortage of seed. The syndicate withdrew from Sind for one year, but has since agreed to make another start. It was stated in evidence by Mr. Henderson, Deputy Director in Sind for some years, that local conditions are unfavourable to co-operation, and the most promising organisation for seed distribution is through the personal influence of leading landlords.

Only small quantities of long-staple cotton have been grown in the Central Provinces, and their inspection and marketing was effected departmentally, the Empress Mills in all cases proving a ready purchaser for full value. The growing of improved wheat through co-operative agency in this province throws an interesting light on the possibilities of a co-operative marketing organisation for obtaining value for quality. The increased value in this case is relatively small, and the cost of sowing an acre very high, compared to cotton, but a considerable degree of success has been obtained through co-operative sales, with the help of one of the big export purchasing firms.

We have unofficial evidence of considerable interest, regarding the state of affairs in the Punjab, but it will require verification by local enquiry. To start with, the market for cotton in this province was in a far less organised state than in other provinces where more cotton is grown. Local buyers at first refused to pay more for a longer staple; indeed, the big exporting firms, it is alleged, tried to discourage the growth of such types, as it complicated the market, and required the use of expert knowledge which their buyers did not possess. A system of Government auctions was introduced, where buyers had to undertake to have the cotton ginned at specified gins under supervision. Prices 45 per cent. above the local rate were obtained at these auctions. On one occasion at any rate before the auction system was introduced, a big exporting firm had sold in Liverpool at *9d.* a pound cotton bought in the Punjab at *4d.*; Bombay buyers, however, gave better prices.

12. This question of improvement has been considered in a good deal of detail, inasmuch as it applies, not only to the introduction of exotic, but to any improvement of the existing varieties. Moreover, sufficient experience has been obtained to show where the difficulties lie, and where help is needed. The problem of inducing the grower to offer a pure type of cotton and the purchaser to give him full value for it, has not yet been solved, though several of the schemes so far devised look promising. The help and goodwill of the mill-owners or other buyers is readily forthcoming. The former no doubt realise that their being first in the field and in a position to secure the pure type in bulk offers them the best chance of being able to keep the long-staple cotton for their own mills in case of outside competition. A free market, however, for long-staple cotton in this country is necessary, if the cultivator is to get the world price for it, and any attempt to restrict this will prove fatal to the introduction of superior types. Little effort seems hitherto to have been made, except perhaps in Madras and the Punjab, to enlist the support of the intermediate local buying interests, often merchants of the Marwari class, who are the most to blame at present for the adulteration of improved types. The attempt is surely worth making, difficult as it undoubtedly is. No satisfactory evidence is forthcoming of the extent to which Indian long-staple cotton commands world prices in Indian markets. Statement No. II appended to this note seems to show that local prices for Tinnevellies followed the world prices for Americans more closely than Westerns, a superior cotton which relies mainly on the Indian demand. The fact that Tinnevellies are regularly quoted on the Liverpool market accounts for this, though the difference between Indian and Liverpool prices was often large, especially when the freight position became more difficult. Finally, it is clear that the first step to take is to devise some means to ensure the cotton coming forward in bulk, unmixed, and if possible, through some organic agency, capable of ultimately taking care of itself with a minimum of Government intervention; or at any rate of being carried on for as many years as possible, until an established course of trade hostile to adulteration has grown up. In small areas, departmental action might serve, but this is impossible over really large areas. In such cases, co-operation seems the most promising means; but it must be recollected that co-operation will not flourish in a soil that has not already been inoculated with its own microbe; we mean that the way to co-operative distribution must in India be paved by acquaintance with and acceptance of the benefits of co-operative credit. Communities accustomed to co-operative credit are suited for the development of an organisation for the sale of a given type of cotton on joint account. There will, however, be many

cases where, for various reasons, the people are either unsuited or unready for co-operative working; and here departmental agency, aided by an ever increasing proportion of help by the trade, seems to offer the best chance of success. The temptation of adulteration is, however, great, where the variety to be introduced is of high quality; and departmental agency must be largely relied on for a long time to replace or supplement co-operative organisation. This will necessitate large additions to the existing staff. The problem of maintaining and marketing a pure type seems so difficult and so urgent, that it deserves for the present as much attention as the purely agricultural problem of producing the type itself.

Conditions under which ryot markets his crop.

13. These conclusions bring one to a consideration of the conditions under which the cotton crop is normally marketed in India. These do not in most cases differ greatly from those prevailing in the case of other export crops. A varying proportion is taken over by merchants or money-lenders who have given advances to the growers, or to whom the latter are indebted. But still a very considerable proportion, naturally more considerable in areas where the average cultivator's holding is larger, is brought by the latter to the market town. In this case the cultivator sometimes sells to a ginnery; sometimes he takes it about from one dealer to another to obtain the best price. In other cases, again, he takes it to a cotton market; where these are well organised, with proper regulations and supervision to prevent the grower being imposed upon, the benefit to the cultivator is great, and he resorts freely to the market. The result is the elimination of unnecessary intermediaries, with profit to grower and mill-owner. An example of such a system is to be found in Berar, where a set of rules has been framed under which cotton markets are constituted and managed. The essential features of this system, which has been described fully in a note by Mr. Standen, Commissioner of Berar, are as follows:—

Commission agents, brakers and weighmen are licensed. The weights used are prescribed and inspected. Trade allowances are forbidden. The prices for the day are not published by the market committee, but become known at once in the market. Unginned cotton is inspected after removal from the market to a gin, and deductions made from the price on account of any defects. The seller need not accept these deductions and may resell his cotton if he likes.

The system, though capable of improvement, works well, and is strongly approved of by the growers. In the absence of such a special organisation, though the grower may have a pretty fair idea of the price he ought to get, yet, owing to the various tricks that are played at his expense by the buyers and the intermediate agents, he does not get it. It seems probable that much could be done for the cultivating classes by a better organised market system. In the case of export crops in particular, it would lend itself to any efforts that may be made to secure price for quality, at any rate after the initial stages had been passed. The necessity of this should be strongly pressed on Local Governments. The tendency in India is to accept as inevitable too many intermediate profits in the up-country period of the movement of an export crop. As the benefits of the co-operative movement spread, the improvements of markets will become a more urgent question. The growers who receive advances on their crop or who sell it to their creditors, in each case on unfavourable terms, will tend to become less numerous; the cultivating classes generally will demand a higher standard of efficiency in marketing, and will be less tolerant of excessive profits at their expense. Something, too, may be done, and is in places being done, by teaching cultivators a few points about marketing their crops.

Adulteration.

14. Proposals for penalising the fraudulent adulteration of cotton have been more than once put forward by various bodies in England and India. Correspondence in the records of the Government of India regarding the proposals made by the International Confederation of Cotton Spinners to Lord Crewe in 1911 may be referred to in particular. We do not propose to touch on the question of mixing cotton of higher with that of lower grades by other agencies than the gins. The experience of the working of the Cotton Frauds Act in Bombay has shown the dangers attending Government action in this matter. Similarly the watering of unginned cotton is in the first place not practised on a relatively large scale and can be put a stop to by the action of the ginners. The watering of ginned cotton by the balers is, however, a much bigger matter; it is done on a large scale and in a thoroughly organised manner, pipes and hoses being used for that purpose in many press compounds, especially in Berar. This might be dealt with without any Government inspecting staff, by allowing the private prosecution (with the sanction of Government, to prevent vexatious proceedings) of any person who actually watered cotton. This might no doubt be effected by a trade organisation; if no action were taken, no harm would be done, and the law would be temporarily ineffective. If necessary, it might be introduced for a term of years in the first instance, and, if not used, could be allowed to disappear automatically from the statute book. Opinions on this point might be invited in Bombay.

Mechanism for carrying out recommendations.

15. The proposals that have been put forward in this note are as follows:—

(1) To improve the existing short-staple types of cotton, by developing, through crossing or selection, a longer and better fibre, while maintaining the high outturn of the low quality type.

(2) In areas where the conditions admit of it, to continue and intensify the present attempts to introduce longer-staple exotic cottons.

(3) To make more determined and systematic efforts to provide a free and effective demand for improved cottons, and to see that they reach the buyer in a pure and unadulterated condition.

(4) To improve marketing arrangements generally, and to prevent some of the more dangerous forms of adulteration.

With regard to (1) it has been stated in paragraph 9 above that the problems indicated are sufficiently difficult and important to justify the appointment of two or three botanists, specially deputed for this work. The improvement of Indian cotton is an urgent matter. It is however possible to speed up research work by the employment of increased staff. This may be done either by tackling more individual problems at once, or by dealing with each individual problem intensively, *e.g.*, by following each experiment through all the life history of the plant in detail, instead of merely recording final results. The strength of the expert staff and the problems which they should take up should be settled by an authority competent to form an opinion on a consideration of the whole aspect of the case, both scientific and economic. In this connection it may be remarked that the Board of Agriculture, as at present constituted does not seem the right kind of body for this purpose. It is too unwieldy, too overburdened with details, and is not equipped for giving adequate consideration to the economic and especially to the industrial aspect of a question like this. Such a body can hardly decide, for instance, to what extent should a staple spinning 20's be aimed at, rather than one spinning 40's. The botanists selected should be required to work at the problems prescribed for them and should not be allowed to alter these, with the sanction of an authority not less competent than that which decided the original lines.

The above are, it is thought, the principles which are best calculated to give the speediest results and in the most economical way. But the task will in any case be a long and difficult one. It is hard for a non-expert to realise what a lengthy, laborious and uncertain process is the building up of a new type. Line after line of work proves infructuous; characters cannot be fixed in combination with other characters; differences are small at first; the plants can be crossed in a single operation, but the botanist can do nothing all the rest of the twelve months but patiently await the result of this single act; and the slightest mistake or accident wastes a whole year. It has taken Mr. Leake, for instance, ten years to arrive only at the beginning of a very promising development. Results, however, occur in a satisfactory proportion of the lines taken up, if the choice is made on reasonable grounds, and the prizes of success are enormous. A gain of six crores of rupees has been mentioned above as the possible result of one particular line of work. That there is nothing improbable in this expectation may be shown by the fact that in the Central Provinces we found that, merely as a result of a botanical examination of the mixture of cottons grown in that province and the selection of the best type of the most profitable of those varieties, an annual addition of over one crore of rupees to the wealth of the local cultivators has been already made by the local Department of Agriculture, over an area of 700,000 acres sown with the seed supplied by Government.

With regard to the third point, this very necessary work is at present carried out by the expert staff of the Agricultural Department, often, it would seem, to the neglect of their more technical duties. Some arrangement should be made, either for the undertaking of these duties by a less highly trained but equally reliable class of Government employé, or for their performance by some non-Government agency.

The improvement of marketing arrangements should be taken up by Government, not only as a necessary condition for the dissemination of improved crops, but in the interest of the people generally. A great benefit would be conferred on the cultivator, and no doubt on the consumer, if the former could be given a market, where buyers would compete freely for his grain or other articles, and he would be reasonably safeguarded from the more undesirable manœuvres of brokers, touts and their allies. The matter might be enquired into, at any rate in the larger provinces, by officers deputed for this purpose; and such system of market supervision might be adopted as the result of the enquiry seemed to indicate as suitable. Moreover, the maintenance of a high standard of efficiency in the supervision of markets should thereafter form a part of the regular policy of Local Governments; a Collector should think it no less a part of his duty to see that his local markets were so arranged as to secure for the grower a fair share of the price and not to add unnecessarily to the cost of the article to the consumer, than to secure efficient sanitation by a Municipality or road-making by a District Board. The proper authority to undertake the supervision of marketing arrangements and of gins is probably the Director of Industries, but the point requires further examination.

STATEMENT No. I.

(*a*) QUANTITY.

Production (in bales of 500 lbs.) as given at page 395 of Professor Todd's book on "The World's Cotton Crops."

	America.	India.	Egypt.	Russia.	China.	Other Countries.	TOTAL.	Consumption (as given on page 410 of Todd's book) in bales of 500 lbs. TOTAL.
1902-03	10,758,000	3,367,000	1,168,000	342,000	1,200,000	801,000	17,636,000	...
1903-04	10,124,000	3,161,000	1,302,000	477,000	1,200,000	751,000	17,015,000	...
1904-05	13,557,000	3,791,000	1,263,000	536,000	756,000	803,000	20,706,000	...
1905-06	11,320,000	3,416,000	1,192,000	604,000	788,000	936,000	18,256,000	...
1906-07	13,551,000	4,934,000	1,390,000	759,000	806,000	1,027,000	22,467,000	20,605,000
1907-08	11,582,000	3,122,000	1,447,000	664,000	875,000	950,000	18,040,000	21,053,000
1908-09	13,829,000	3,692,000	1,150,000	698,000	1,033,000	969,000	22,271,000	22,387,000
1909-10	10,651,000	4,718,000	1,000,000	686,000	2,531,000	950,000	20,536,000	22,318,000
1910-11	12,132,000	3,853,000	1,515,000	895,000	3,467,000	967,000	22,829,000	24,605,000
1911-12	16,043,000	3,288,000	1,485,000	876,000	3,437,000	1,058,000	26,186,000	26,126,000
1912-13	14,129,000	4,395,000	1,507,000	911,000	3,931,000	1,171,000	26,044,000	26,863,000
1913-14	14,610,000	5,201,000	1,537,000	1,015,000	4,000,000	1,340,000	27,703,000	27,000,000
1914-15 *Estimates.*	16,500,000	5,000,000	1,300,000	1,300,000	4,000,000	1,300,000	29,400,000	...

(*b*) VALUE (IN RUPEES).

1902-03	2,16,84,09,000	32,45,82,000	18,95,81,000	5,42,28,000	14,91,06,000	11,70,57,000	3,00,29,63,000	...
1903-04	2,46,77,25,000	32,14,18,000	28,38,36,000	7,56,34,000	15,51,69,000	13,00,62,000	3,43,38,44,000	...
1904-05	2,60,54,86,000	48,39,05,000	27,73,07,000	8,49,89,000	12,25,23,000	14,06,18,000	3,71,50,28,000	...
1905-06	1,60,02,17,000	35,76,12,000	22,46,02,000	8,16,55,000	10,13,36,000	13,22,15,000	2,58,77,27,000	...
1906-07	2,32,23,03,000	58,64,52,000	33,98,55,000	11,28,77,000	11,23,78,000	16,90,22,000	3,64,28,87,000	3,39,08,10,000
1907-08	2,14,70,13,000	35,99,89,000	39,78,35,000	10,81,84,000	13,62,09,000	16,99,16,000	3,31,92,36,000	3,76,58,55,000
1908-09	2,25,75,84,000	41,06,96,000	24,30,09,000	10,49,09,000	24,69,10,000	14,85,04,000	3,42,08,12,000	3,43,08,08,000
1909-10	2,00,77,13,000	58,61,87,000	24,20,02,000	10,83,63,000	42,20,97,000	16,71,11,000	3,58,35,33,000	3,92,51,78,000
1910-11	2,85,17,78,000	60,02,85,000	51,48,16,000	16,66,90,000	58,95,89,000	21,02,22,000	4,93,33,80,000	5,34,85,12,000
1911-12	3,25,47,24,000	54,30,68,000	40,63,33,000	14,80,02,000	62,85,95,000	21,03,66,000	5,19,09,88,000	5,19,25,42,000
1912-13	2,53,08,57,000	64,74,38,000	39,29,50,000	14,37,81,000	70,66,59,000	21,65,92,000	4,63,82,77,000	4,96,79,76,000
1913-14	2,91,19,56,000	80,74,01,000	44,15,03,000	16,09,41,000	74,20,00,000	27,71,46,000	5,34,00,47,000	5,58,39,37,000
1914-15	2,94,83,44,000	56,95,83,000	31,97,10,000	20,61,31,000	57,23,75,000	22,15,35,000	4,83,76,87,000	...

NOTE.—The valuation has been made on the basis of the prices prevailing in the different years.

STATEMENT No. II.

Showing the prices of 'Tinnies' at Tuticorin *as compared with those at* Liverpool.

Period.	PRICES PER lb. IN ANNAS AND DECIMALS.				PRICE PER BALE OF 500 lbs. IN £ AND DECIMALS OF £.		
	American middling at Liverpool.	Tinnevelly at Liverpool, F. G. F.	Tinnies at Tuticorin, F. G. F.	Westerns per lb.	American middling at Liverpool.	Tinnevelly at Liverpool, F. G. F.	Tinnies at Tuticorin, F. G. F.
1	2	3	4	5	6	7	8
					£	£	£
31st December 1914	4·58	4·00	3·20	2·88	9·54	8·33	6·67
15th January 1915	4·80	4·24	3·52	2·88	10·00	8·83	7·33
29th January 1915	5·02	4·54	3·20	3·52	10·46	9·46	6·67
12th February 1915	4·97	4·54	3·52	3·36	10·35	9·46	7·33
26th February 1915	4·97	4·54	3·52	3·68	10·35	9·46	7·33
12th March 1915	5·17	4·81	3·68	3·78	10·77	10·02	7·67
26th March 1915	5·48	5·14	4·19	3·97	11·42	10·71	8·74
16th April 1915	5·75	5·44	4·42	4·06	11·98	11·33	9·20
30th April 1915	5·66	5·40	4·48	4·45	11·79	11·25	9·33
14th May 1915	5·30	5·10	4·16	4·16	11·04	10·62	8·67
4th June 1915	5·35	5·15	4·06	...	11·14	10·70	8·47
11th June 1915	5·37	5·20	4·03	3·60	11·18	10·83	8·40
25th June 1915	5·20	5·10	3·94	3·58	10·83	10·62	8·20
9th July 1915	5·17	5·00	3·84	3·65	10·77	10·42	8·00
23rd July 1915	5·13	5·05	3·78	3·57	10·69	10·52	7·81
6th August 1915	5·53	5·25	4·00	3·36	11·52	10·94	8·33
20th August 1915	5·42	5·15	4·00	3·36	11·29	10·73	8·33
3rd September 1915	5·78	5·40	4·10	3·74	12·04	11·25	8·53
17th September 1915	6·14	6·05	4·80	4·00	12·78	12·60	10·00
1st October 1915	6·97	6·43	4·80	4·72	14·52	13·40	10·00
15th October 1915	7·23	6·85	5·31	4·83	15·06	14·27	11·07
29th October 1915	7·02	6·65	4·96	4·86	14·62	13·85	10·33
12th November 1915	7·01	6·60	5·02	4·17	14·60	13·75	10·47
26th November 1915	7·28	6·90	5·06	4·64	15·17	14·38	10·53
11th December 1915	7·66	7·25	5·06	4·64	15·96	15·10	10·53
25th December 1915	...	...	4·86	4·48	...	...	10·13
31st December 1915	7·92	7·50	...	...	16·50	15·63	...
14th January 1916	8·79n	7·75	5·50	4·74	18·33	16·15	11·47
29th January 1916	7·93	7·70	5·54	4·86	16·52	16·04	11·53
11th February 1916	8·06	7·75	5·54	5·40	16·79	16·15	11·53
25th February 1916	7·72	7·50	5·79	5·63	16·08	15·63	12·07
17th March 1916	7·87	7·65	6·03	5·89	16·40	15·94	12·53
31st March 1916	7·77	7·50	6·08	5·76	16·20	15·63	12·67
14th April 1916	7·78	7·55	5·82	5·42	16·22	15·73	12·13

STATEMENT No. II—*contd.*

Showing the prices of 'Tinnies' at Tuticorin *as compared with those at* Liverpool—contd.

Period.	PRICES PER lb. IN ANNAS AND DECIMALS.				PRICE PER BALE OF 500 lbs. IN £ AND DECIMALS OF £.		
	American middling at Liverpool.	Tinnevelly at Liverpool, F. G. F.	Tinnies at Tuticorin, F. G. F.	Westerns per lb.	American middling at Liverpool.	Tinnevelly at Liverpool, F. G. F.	Tinnies at Tuticorin, F. G. F.
1	2	3	4	5	6	7	8
					£	£	£
28th April 1916	7·94	7·65	5·79	5·50	16·54	15·93	12·07
12th May 1916	8·44	8·10	6·05	5·80	17·58	16·87	12·60
26th May 1916	8·47	8·10	6·02	5·26	17·65	16·87	12·53
9th June 1916	8·42	8·00	6·14	5·76	17·54	16·67	12·80
23rd June 1916	8·29	7·90	6·14	5·89	17·27	16·46	12·80
7th July 1916	8·04	7·65	6·24	6·08	16·75	15·94	13·00
21st July 1916	7·97	7·65	6·27	6·05	15·60	15·94	13·07
4th August 1916	8·57	8·20	6·53	6·50	17·75	17·08	13·60
18th August 1916	8·86	8·45	6·34	6·62	18·46	17·60	13·20
1st September 1916	9·90	9·20n	6·72	6·88	20·63	19·17n	14·00
16th September 1916	9·51	8·95n	6·59	6·78	19·82	18·65n	13·73
29th September 1916	9·47	8·90n	6·53	6·78	19·73	18·54n	13·60
13th October 1916	10·11	9·40n	6·85	6·78	21·06	19·58n	14·27
27th October 1916	11·14	10·40n	6·82	...	23·21	21·66n	14·20
10th November 1916	11·42	10·00n	6·75	7·26	23·79	22·71n	14·07
24th November 1916	11·90	11·30n	7·49	7·46	24·79	23·54n	15·60
8th December 1916	12·05n	11·45n	8·00	7·74	25·10n	23·85n	16·67
22nd December 1916	10·09n	9·65n	8·00	7·42	21·02n	20·10n	16·67
5th January 1917	10·96n	10·45n	...	...	22·83n	21·77n	...
19th January 1917	...	...	...	...	...	...	...
2nd February 1917	10·33n	9·90n	...	...	21·52	20·63n	...

APPENDIX C.

THE SUGARCANE INDUSTRY.

Sugar problem in India.

The sugar problem in India is capable of being stated very simply. In the last year before the war (1913-14), the area under cane in the provinces for which returns are received was 2,659,800 acres, from which a normal yield of *gur* would be 3,428,000 tons. *Gur* is also produced in some provinces from palm trees to the extent of about 150,000 tons, but the quantity apparently does not vary much from year to year, and has not been affected by the war. In the year 1913-14 the imports of sugar and molasses together were 896,800 tons. To what extent can these imports be replaced by sugar produced in India?

Production in India.

2. During three years of war the average annual imports of sugar have decreased by 256,000 tons, whilst the increased area brought under cultivation is capable of producing about 350,000 tons of *gur*. The tables given below furnish the data upon which the above statement is based.

TABLE I.

Provinces.	Normal yield of *gur* in tons per acre.	1913-14.		1917-18.	
		Area in acres.	Outturn in tons.	Area in acres.	Outturn in tons.
Bengal	1·3	216,500	281,400	207,000	269,100
Bombay	3·1	63,500	196,800	113,000	350,300
Madras	2·2	83,600	183,900	123,000	270,600
United Provinces	1·2	1,389,300	1,667,200	1,497,000	1,796,400
Bihar and Orissa	1·1	262,900	299,200	263,000	289,300
Punjab	0·9	410,800	369,700	502,000	451,800
Central Provinces	1·1	20,400	22,400	25,000	27,500
Assam	0·9	37,900	34,100	35,100	31,500
North-West Frontier Province	2·0	31,800	63,600	31,000	62,000
Minor Areas	1·3	24,900	32,400	22,000	28,200
Total	...	2,541,600	3,150,700	2,818,000	3,576,700
Native States	1·5	118,200	177,300	(not available).	
TOTAL	...	2,659,800	3,328,000	...	...

Table I gives the area under sugarcane in 1913-14 compared with the final forecast of 1917-18. These areas multiplied by figures furnished by the Agricultural Department for the average outturn per acre of each province give the weight of *gur* produced in a normal year from the area under cultivation. From the statement it will be seen that in 1913-14 the crop in British India, if the yield was an average one, was 3,150,000 tons, and in the Native States from which returns are received 177,000 tons; whilst in 1917-18 on the same assumption the crop in British India will be 3,576,000 tons, an increase of 426,000 tons. Figures for the Native States are not yet available, but it is fairly certain that they would show a somewhat similar increase, *viz.*, 13 per cent., and we may, therefore, assume that the total increased production of India will be about 450,000 tons. Areas for which no figures are furnished are the Native States of Hyderabad, Baroda, Baluchistan and Sikkim.

TABLE II.

Year.	Imports of sugar in tons.	Value in £ sterling.
1912-13	772,153	9,519,172
1913-14	896,869	9,971,251
1914-15	550,120	7,014,990
1915-16	642,744	11,078,531
1916-17	542,218	10,300,210

Table II furnishes the imports of sugar into India from outside with the values expressed in sterling for the five years 1912-17. The rapid increase in the rate of importation came to an end with the outbreak of war. In the two years immediately preceding the war, imports averaged 834,000 tons; whilst in the three years of war they have fallen to an average of 578,000 tons, a decrease of 256,000 tons. The expenditure on foreign sugar shows little change; the average annual imports in the pre-war years referred to were valued at £9,748,000 and in the war years at £9,469,000. That is to say, the fall in volume of imports was almost exactly counterbalanced by the rise in price. From this it would seem that India is able to spend about ten millions sterling a year on sugar, which may be regarded somewhat in the nature of a luxury, and that for her ordinary dietary *gur* is sufficient. The rise in the price of sugar diminished the quantities consumed, and this deficiency has been made up by an equivalent amount of *gur*. The increase in cane cultivation is a very satisfactory feature of the situation, and justifies the expectation that the efforts now being made by the Government to raise the standard of agricultural practice will result in a very marked advance in the industry, both as regards area cultivated and yield of crop.

It will be observed from Table I that cane cultivation is very unequally distributed throughout India and that by far the greater area is situated in the alluvial plains of the Ganges and Indus river systems. The weight of the cane crop per acre in the south of India is, however, much greater than in the north, where the cold season is too prolonged to yield, at any rate with the present types of cane, the returns obtained in the warmer and more equable climate of the south. Further the percentage of available sucrose, upon which the weight of *gur* extracted depends, is appreciably larger. In Bombay and Madras, too, the cultivation is better, irrigation is fuller, and manuring is on a far more liberal scale. Cane growing in these southern provinces is, however, dependent for its extension on storage irrigation, though much may be done also by power pumping from wells or rivers. Any large increase from wells worked by bullock power is not to be expected. In the United Provinces and the Punjab, where snow-fed canals exist on a large scale (by far the most economical form of irrigation for a crop requiring water during the hot weather), climatic conditions are less favourable, but the cane areas are larger than those of the southern provinces. A very large acreage is grown in Bengal, Bihar and the United Provinces, practically speaking without irrigation. In the United Provinces, even where irrigation is given, it is mostly very scanty, except where canes are grown for chewing; and it is improbable that it can be materially increased. In the small, highly-cultivated cane areas of Madras and Bombay, and to a less extent in the Central Provinces, the work of the Agricultural Departments has been more effective than in the large, ill-cultivated cane areas of the small and poor cultivators of the United Provinces.

Agricultural improvement. Results of past working in the provinces.

3. The main line along which the problem must be attacked is obviously that of agricultural improvement. The policy should be generally to continue the improvement, along existing lines, of the Madras and Bombay crops; to introduce varieties into the northern provinces which will give the best results under existing conditions of temperature, water supply and climate; and to induce the growers of the northern tracts to take up, along with better types of cane, higher manuring and cultivation. The extension of irrigation in the southern provinces will doubtless be continued on the lines best calculated to obtain for the growers the greatest benefit in return for the money expended. Some share of this is bound to fall to sugarcane. It has been found that in Bombay, at any rate, cane growers are ready to pay as much as Rs. 60 per acre for the irrigation of thick varieties, and it seems hardly necessary to press the claims of cane to any special treatment in these areas.

Madras.

Turning to the purely agricultural work done in the various provinces, we find that in Madras considerable improvements have been effected by the introduction of a disease-proof cane, with the result of arresting the decline of the cane area in the deltaic tracts. Improved methods of cultivation have also led to an increase in the area under cane, owing to the larger profits thereby obtained. No estimate is available to the Commission of the probable increased area to be looked for owing to greater irrigation facilities, or of the amount of improvement in the yield per acre that the Agricultural Department has in view.

Bombay.

Mr. Keatinge, the Director of Agriculture, anticipates that, out of the areas in Bombay over which irrigation is now to be extended, some 80,000 acres are likely to be planted with cane. The Agricultural Department, by an application of water and manure in quantities actually less than those given by the local growers, secured a crop in 1915-16 of 50 tons of cane yielding six tons of *gur* per acre. The use of ammonium sulphate together with oil cake in addition to farmyard manure was found to be the most economical form of manure. Sulphate of ammonia is admittedly suitable for sugarcane in many parts of India; and the general adoption of coke-oven recovery plants on the coal fields should lead to an increased supply at a lower price, which would be a great benefit to the cane industry.

Central Provinces.

In the Central Provinces the agricultural improvements at present being demonstrated, though promising enough in their way, are not likely to make any very large difference to the gross yield, as the area under cane is so small. Much, however, depends on the quantity of water likely to be made available for cane as the result of the numerous irrigation works under construction or projected in this province. The irrigation of cane from storage works in this part of India does not, judging from the history of the past few years, seem very promising, owing to the heavy losses from evaporation and leakage in channels, when small quantities of water are passed along them in the hot season. The extension of the storage capacity of the reservoirs feeding the Mahanadi canals may, however, afford a largely increased supply of water for cane. Very high yields can be obtained in the south of the Central Provinces where conditions approximate to those in Bombay or Madras.

United Provinces.

An important factor in the United Provinces is the result expected from the crosses which are being produced in the experimental area in Coimbatore. But Dr. Barber, the Sugarcane Expert, reports that he will not be able to test these and give them out to the Government farms for local trial till 1921. If a seedling cane, combining the hardiness and resistance to unfavourable climatic conditions of the local United Provinces varieties with something of the increased yielding power of thicker exotic species, can be evolved, then the prospects of increased production on, and extension of, the existing area are very hopeful. But in order to make this possible, the ryots must be induced to improve their cultivation and to adopt an altogether different standard of manuring. Meantime, the report of the meeting of the Board of Agriculture in 1916 states that a Java variety can be grown successfully in the United Provinces, with slight modifications of the local agricultural methods, to yield 70 per cent. juice in a nine-roller mill, with 15 per cent. sucrose, while the local varieties, under the same conditions give only 55 per cent. juice, with 10 to 11 per cent. sucrose. The above are the results of crushing on a considerable scale at the Rosa factory, and the variety in question, which was grown by the factory, has been thoroughly tried in other parts of the United Provinces. The prospects seem very favourable, and all now depends on a successful demonstration campaign. It will be necessary to provide very large quantities of manure in the form of oil cake, for it is at least doubtful if the local supply of farmyard manure can be greatly increased in the near future.

The United Provinces Government is taking steps to popularise the use of mahua cake as a manure for cane. The example of Formosa,* where the Japanese Government advanced £2 worth of fertilisers for every 2·4 acres put under cane, on condition that the cultivator himself spent another £2-10*s*. On fertilisers, has often been quoted, and whatever may have been the result of certain other measures taken in that island for the encouragement of sugar cultivation, there is no doubt that this or some modification thereof, would afford a great stimulus in India. It is necessary however, to make absolutely certain that the new canes are in every way suitable, and are not liable to ruinous damage from local pests or diseases. It is probable, for instance, that damage from pig would be a serious matter in the United Provinces and Bihar, if thick cane were introduced, and it would be difficult to arrange for effective protection of the small scattered areas.

North-West Frontier Province.

Although situated in the extreme north-west corner of India and exposed to bitter frost in the cold weather, sugarcane is grown in the North-West Frontier Province under irrigation from river channels, on an area of 31,000 acres, and a yield of over two tons of *gur* is obtained from an average crop of 28 tons per acre. The area is said to be limited by the local demand for *gur* and the difficulty experienced by the cultivators in manufacturing it. The Agricultural Department has for some years past conducted experiments with a view of introducing a modern factory system of cultivation and manufacture, and the results indicate that the prospects of success justify the establishment of an experimental Government factory, which could be developed into a large concern drawing its supplies of cane from a maximum area of 5,000 acres. At the same time the prospects of beet sugar cultivation have been investigated with almost equally favourable results, and it is suggested that a central factory, if erected near Nowshera, could obtain supplies of both cane and beet which would enable it to operate for between seven and eight months in the year. This unusually long period is partly due to the fact that the cane after cutting can be preserved with little or no deterioration over a period of several months. At very small cost, therefore, the gap between the end of the cane and the beginning of the beet harvest can be bridged. The beet harvest can also be prolonged by sowing in September and October and again in February and March. No information is available as to the ultimate extent to which developments in the direction of this combined cultivation could be carried, but it is probable that the initial success of one factory would lead to the establishment of others and that the ultimate limit would depend upon the extent of land which could be brought under irrigation. This might possibly be increased by the employment of pumping plants on a large scale.

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* P. Geerligs' World's Cane Sugar Industry, 1912, page 86.

There are in Assam and Burma large areas of land suitable for the cultivation of sugarcane without irrigation; but it is probable that irrigation supplementary to the rainfall will be found to be very profitable, and this can be supplied by the addition of small pumping installations capable of lifting water from the rivers and streams, which in these provinces are of a perennial character. The area under cultivation in Assam in 1917-18 is stated to be 35,000 acres, with an average yield of only 0·9 tons of *gur* per acre. This outturn is recognised to be much less than might be obtained with good cultivation ; and, at the instance of the Board of Agriculture, the Local Administration has started experiments at Kamrup with a view to develope cane cultivation on modern lines and to work up the crop in a large central factory to produce white sugar. The experimental work commenced in 1914-15 and has gradually developed, though progress has been delayed by the difficulties in getting machinery for the central factory. Up to date nearly 700 acres of land have been broken up by steam-ploughing tackle, and 530 acres planted with cane. The erection of the manufacturing plant has not kept pace with the agricultural developments, and no commercial results are yet available. The experiment is an exceedingly important one, and, though unforeseen difficulties have been met with, the results so far obtained are very promising, and there is every reason to expect that it will ultimately prove the possibility of establishing in Assam the central factory system of growing cane. **Assam.**

In Burma the area under cane in 1913-14 was 15,100 acres. Here an attempt was made to get a central factory started, but owing to the war the idea had to be given up. The proposal was that a Rangoon firm should undertake to make experiments in the area commanded by the Minbu canal, at a cost of Rs. 20,000, half of which was to be paid by Government. If they proved successful, the firm was to lay down plant capable of dealing with an area of 10,000 acres. It is stated that crops of 30 tons per acre without manure have been obtained on the Government farm. **Burma.**

It seems that promising tracts exist in these two provinces, for the establishment of central factories, growing at any rate a large proportion of their own cane, but that there are many initial difficulties to overcome, especially in the matter of labour. Areas taken up for cane growing would presumably be free from tenancy rights and other incidents of our Indian revenue system. It is especially this freedom from legal difficulties that inspires a hope that a really considerable quantity of sugar might ultimately be produced in Burma and Assam. Dr. Barber, who has visited the former province, regards the conditions there, apart from labour difficulties, as very promising, and it should be the policy of Government to give out suitable areas for the establishment of central factories to reputable firms, and to invite such applications. The system followed should provide for small cultivators growing cane alongside the larger areas of the factories, a condition which the probable necessity of importing labour renders the more important.

General.

In accordance with the recommendations of the meeting of the Board of Agriculture held in 1911, Dr. Barber has been engaged on the production of seedlings suitable for various conditions of soil and climate, and also seedlings with maximum sucrose content. Very promising results have been reached in this latter direction as the result of two seasons' work. An agricultural question of importance to the factory owner is the extension of the period during which cane can be obtained ready for crushing, by selecting varieties that ripen at different times, or by extending the period of planting so as to prolong the ripening period. If, as stated in the note prepared by Mr. Coventry on cane growing in Bihar and printed in the Report of 1916 (page 90) of the Board of Agriculture, early planting does not lead to early ripening, this may be owing to the cold of the early winter months, as in the warmer climate of the south of the Central Provinces, the opposite was found to be the case. Two different classes of cane, one early and one late ripening, could, however, as Mr. Coventry stated, be grown in Bihar side by side, thereby extending the period.

Manure.

4. In view of the shortage of farmyard manure, it is necessary to employ some substitute which can replace farmyard manure wholly or partially. This exists in the form of various kinds of oil cake, which, at any rate in the case of heavily manured and well cultivated land in Bombay, gave the most economical results when used with ammonium sulphate. The stimulation of the oil-pressing industry that would arise from an increased demand for cake would be a desirable end. Sulphate of ammonia was sold in India before the war (June 1913) at Rs. 257 per ton; it should be possible to sell sulphate of ammonia produced in India at a much lower price than the imported article.

Cost of cultivation and availability of cane.

5. The cost of cane cultivation and the prices paid for cane by factories are of interest in this connection. The usual price paid for the poor class of cane obtained by factories in the United Provinces and Bihar before the war was four annas a maund. The price however varied between 3½ and 6 annas, according to the price of *gur* and competition between factories. Higher prices were said by the Bihar witnesses to have been paid since the war, but generally, the price in Bihar is much the same as in the United Provinces. In places where a thicker class of cane is grown, much higher prices are the rule, although, except in Madras in the neighbourhood of the sugar factory at Nellikuppam, there is very little purchase of cane on a commercial basis in such tracts. The ryot in Madras and Mysore takes his cane to the power-driven mill and gets it crushed and the juice boiled down to *gur*. For this he pays the charges levied by the owners of the mill, and then he sells the *gur* himself, obtaining a price equal to 10 to 12 annas per maund of cane. The lowest price in pre-war times was eight annas a maund. Enquiry in connection with experiments in the Hadi process in the Central Provinces showed that nine annas a maund was the lowest figure that would satisfy the cultivators. In Bombay, it cost the Agricultural Department slightly over four annas to grow a maund of cane in 1915-16. Most Bombay and Madras canes have a much higher percentage of extraction and usually of sucrose than the northern canes, but not, it would seem, enough to account for the great difference in price. Canes which are doubtless somewhat of the same class as those grown in Bombay

and Madras are grown in Fiji and Mauritius. In Fiji the nett cost to the factory is three annas a maund, including the expense of planting, cutting and transporting, which is borne by the factory. In Mauritius, the Indian growers get 5·3 annas a maund. The Formosan grower receives on an average 4½ annas a maund for a cane with 11 per cent. sucrose contents. This approximates fairly closely to United Provinces conditions. Until the Bombay grower is ready to sell his cane at a price which may be provisionally stated at six annas a maund or a little more, on a pre-war sugar price basis, it does not look as if a central factory would have much chance of success in that Presidency. Efforts have been made in the United Provinces to induce the ryots to sell their cane on a basis of extraction, but without success. If improvement were taken up on a large scale, the growers of better cane would doubtless be ready to sell on a basis of extraction results; and if so, the growing of inferior types would no doubt tend to decrease more rapidly.

In the southern provinces, on the other hand, the problem would seem to be one of increasing the area under cane until the market for *gur* is overdone. If the yield is so large as to make the growing of cane still profitable on a lower price basis for *gur*, and therefore for cane, an opening for the central factory will at once be created. If, however, a fall in the price of cane to a point still above what a central factory can afford to pay, leads to a decline in area, the future prospects of sugar making in these tracts are not promising. Here the Agricultural Department can be of assistance, by showing the cultivator how to grow as much cane per acre as possible in the most economical way. Another difficulty, however, which must be faced, is that due to the small area of cane in any given tract, and efforts will have to be made to bring about a greater concentration in favourable situations, so as to diminish as much as possible the cost of transport to a central mill.

Agricultural improvement future work.

6. It would seem, then, that there is a possibility within the next few years (1) in the southern provinces of a considerable increase in the area under the irrigation works combined with some increase in outturn, (2) in the northern provinces, if the policy laid down by the Board of Agriculture is vigorously pursued, of a very large increase in the outturn of the existing area, and possibly of an extension of that area in consequence of the more profitable nature of the crop. This is so much larger than all the southern areas together, that no effort should be spared to promote improvements on lines already ascertained to be suitable. In particular, the establishment of a sugarcane farm in the part of Bihar north of the Ganges should be no longer delayed. In this tract we found the main sugarcane areas and practically all the factories of the province, and it adjoins a part of the United Provinces where much cane is grown. The establishment of central cane factories (3) in Assam and Burma offers promising prospects.

There seems no reason why the various increases above indicated should not yield *gur* or sugar, equal or more than equal to the quantity of sugar at present imported.

Limitation of area due to prices of other crops.

7. There is, however, another very important factor which affects the area under cane—*viz.*, the price of other crops. This is especially marked in the case of jute in Bengal.

The cane areas in Bengal (including Assam) and in the United Provinces in the year 1890-91 were 1,146,611 acres, and 1,104,334 acres respectively (Agricultural Statistics figures). In the year 1907-08 they were 616,032 acres and 1,471,831 acres, although the yield in Bengal is certainly higher than in the United Provinces. One reason for the decline in the case of Bengal may be seen from the statement below:—

Period.	Price of jute, per bale, Calcutta.			Total area under jute (India) acres.	Price per maund Valley *gur*, Calcutta.			(Final forecast) Area under cane (Bengal).
	R	a.	p.	*	R	a.	p.	Acres.
Average of 5 years ending 1904-05	33	8	11	2,530,308	3	14	9*	680,380
Year 1905-06	57	8	0	3,140,822	4	8	3	623,100†
1906-07	50	11	8	3,523,558	4	3	2	606,700†
1907-08	39	1	5	3,942,675	4	3	5	607,200†
1908-09	32	9	4	2,835,454	6	3	9	553,000†
1909-10	36	10	8	2,756,820	6	12	2	507,800†
1910-11	40	9	8	2,828,669	6	2	0	515,600†
1911-12	54	4	0	3,090,827	4	12	0	521,000†

* Average for 3 years only.

† Including Assam.

Gur fell even lower in the next two years; but during the above period the price of *gur* rose 18 per cent. and that of jute 61 per cent. The area under cane declined by 23 per cent. and that under jute rose by 22 per cent.

Demands for *gur*.

8. It is difficult to draw definite conclusions from such statistics as are available regarding either the production of *gur* or the prices realised in free markets. *Gur*, as ordinarily made, does not keep well in damp weather, and immediately after the cane harvest season the crop is thrown on the market, owing to the inability of the ryots to hold it for any length of time. Consequently there are violent fluctuations in price, and the bulk of the crop has to be sold at the time when prices are lowest. Average rates, therefore, are totally misleading as regards the actual cash returns received by the growers.

There is no reliable evidence of a decreased demand for *gur*, as the percentage of the Indian cane crop which is made into sugar is still small, and the figures show that, if anything, there has been in recent years an increase in the area under cane, which is likely to become of greater importance now that the price of imported sugar has risen.

The rapid increase in the imports of sugar is, therefore, due to the increased demands of the people for saccharine matter, consequent upon a rise in the standard of living, and it is an open question whether the anticipated increase in the production of sugarcane in India will be used in the form of *gur* or manufactured sugar. If the demand is for *gur*, the prices for that product will remain high, and it will be difficult for factories producing sugar to obtain supplies of raw material. On the other hand, if the demand is for sugar, the present ratio of prices between *gur* and sugar will not be maintained, *gur* will become cheaper and the sugar refineries will be able to purchase it. Hitherto, sugar has been the only article of food which, to any considerable extent, has been imported into India, and the cane grower and therefore the *gur* producer have been subject to competition from an overstocked market which was artificially supported by bounties and cartels. While world prices for food grains and fibres capable of being grown on land suitable for sugar have risen, the prices for sugar have steadily fallen, and consequently the Indian sugar grower has found his cultivation less profitable. His methods of cultivation have remained unchanged, but to some extent his returns have been increased by the use of iron sugar mills. Recent work by the Departments of Agriculture and of Industries in some provinces has, however, demonstrated definitely that there is scope for great advances in the yield of cane by better cultivation and in the extraction of its sugar contents by the use of power-driven milling machinery. The adoption of these new methods and appliances will increase the returns per acre without increasing the cost of production in a similar ratio, and, the margin of profit being thus extended, the area under cultivation will grow till the returns cease to offer inducements for any further expansion.

Economic limits of central factories.

9. No reliable information is at present available regarding the economic limitations of the central factory system in India. There is both an upper and a lower limit, but the former need not concern us as it is never likely to be reached in India. The lower limit depends on the degree of efficiency in manufacture which can be obtained when working on a small scale, and on this point the experiments in progress in the United Provinces have not yielded any satisfactory data. That the efficiency will be less than would be obtained with larger plant is certain, but the loss on this account may be counterbalanced by the diminished cost of transport, when the cane supplies have to be carried only a short distance and there is a local market for the whole outturn. The cost of management is also a factor of some importance, and small Indian central factories should be able in this respect to hold their own against the somewhat expensive control of the larger factories. At the present time the lower limit of the factory system seems to be a mill capable of dealing with 250 tons of cane per day, or with the produce of an area of 25 acres in the north of India or of 10 to 12 acres in the south. Assuming a working season of 100 days, the smallest central mill will require 2,500 acres of cane in the north of India and from 1,000 to 1,200 in the south. Only in a few places can such large areas be secured, and it is urgently necessary to encourage concentration of cane growing as much as possible, simultaneously with the technical development of sugar manufacture on a small scale.

Working of Indian sugar factories.

10. There were in 1915, 23 sugar factories in British India employing 50 or more persons, and three in Native States. Of the above, nine were in the United Provinces, seven in Bihar and Orissa and five in Madras. Some obtained their sugar from *gur* only and not from cane directly, some worked only on cane, and others on both. Some of these factories also worked as distilleries ; and in one or two cases they turned to account the carbonic acid gas from the fermentation vats by compressing it in steel cylinders for the use of manufacturers of ærated waters. One factory has carried the sugar industry to the stage of producing sweets.

The limited commercial success attained by sugar factories and refineries in India until somewhat recently, was largely due to imperfect appreciation of the conditions under which the industry must be carried on in India, and to bounty-fed competition from abroad. At the present time the price at which sugar is landed in India is not the only factor in determining whether a season's work will result in a profit or a loss ; this depends to a large extent on the current prices of *gur*, which often bear no relation to those of sugar. If the season is poor, *gur* is dear, and unless sugar is also dear, the mills cannot make a profit. But war conditions have, for the time being at any rate, enabled sugar factories to work at a considerable profit.

Obviously the greatest help for existing, and the greatest security for projected mills is a plentiful supply of suitable cane. If this is not available, nothing short of very high protection will have much effect.

Difficulties from point of view of central factory.

11. It must be understood that the peculiar conditions under which cane is grown in India present certain special difficulties, from the point of view of the central factory. As in many other countries, cane cannot be grown in India to advantage continuously in the same plot, except where it is ratooned; it has to be rotated, preferably on at least a three years' system, with other crops; and the areas in which it is grown are very small and scattered. It is, however, sometimes grown by a number of small cultivators in one block, fed either by tanks or canals. In the latter case, rates and water supply are often regulated so as to concentrate cane in blocks, in order to economise water. In Bihar and the United Provinces in particular, holdings are very small, and where cane is grown without irrigation, or from wells, the result is a number of very small isolated patches. In tracts which are subject to the ravages of wild animals, an additional inducement to concentration is found in the facilities given thereby for watching and fencing the crop.

The tenancy law in most parts of India renders it impossible for a capitalist to acquire continuous areas for factory cultivation, and it is more than doubtful if Government would be justified in permitting the compulsory acquisition of these, or if it would be practicable for a factory to acquire such by private negotiation, supposing that a clear title could be passed. The number of cultivators to be expropriated would be very large in proportion to the industrial results; and the process would have to be repeated every time a new factory was started. It would be almost impossible to provide other land for the expropriated cultivators, and much hardship and discontent would be created.

Difficulties retarding expansion of cane growing.

12. Another factor that has to be taken into account is the lack of available bullock power for crushing cane. It will be remembered that by far the greater proportion of Indian cane is made into *gur*, the cane being crushed in bullock mills and the juice boiled by the cultivator himself. As a rule, the cattle power is insufficient to deal economically with the cane grown. The cattle are overworked and weakened by the hard toil of the mill, following on the continuous ploughing of the monsoon and the *rabi* sowings. The temptation to the cultivator to slack off the mill, with much resultant loss in extraction, is great. Again the crushing season is often prolonged till the canes have deteriorated. One or more of these conditions are usually to be found in all areas where cane is grown to any considerable extent. It is manifest, therefore, that the expansion of cane growing, in the absence of a central factory, will be held up, unless some suitable means of crushing cane otherwise than by bullock power can be devised. The replacement of cattle by mechanical power plant, however, will further accentuate the shortage of farmyard manure, to which we have already alluded, and render the necessity of artificial manures more urgent.

The original form of cane mill in India was the old stone pestle and mortar, revolved by bullock power, with an extraction of about 33 per cent. in its most primitive form. This type has now almost disappeared. The mill with wooden rollers was an improvement on it, but worked very heavily, with much strain on the bullocks; it gave an extraction of about 50 per cent. Various types of iron mill have now for the most part superseded both, and these are sometimes purchased by the cultivator, but are also often hired out by firms, especially in northern India and Bengal, at so much a day, the cultivator finding the bullocks and labour.

Efficiency of bullock-driven mills.

13. The highest extraction that can be effected by the best type of bullock-driven mill is about 68 per cent., or in the case of one or two types 70 per cent. This high rate can only be got from thick cane, and can only be maintained

by the use of good bullocks regularly relieved. Under similar conditions, about 62 per cent. might be obtained from medium-sized canes, such as the *sarathi* grown in the United Provinces. From 50 to 60 per cent. extraction is effected by the less efficient types of mill, according to the class of cane crushed, the number of rollers and their setting. A two-roller mill gives about 56 per cent. under the most favourable conditions; but it must be remembered, first, that a cultivator has by no means always enough cattle to work his mill up to its highest extraction capacity, and is often tempted to slack the setting of his rollers to enable the mill to work faster. The result is that he burns under his evaporating pans one-third of the sugar he produces, to turn the other two-thirds into *gur*. In the next place, the rollers are not usually of hardened metal, and get worn more in the middle than at the ends. This also causes much waste of juice.

Small power plants to crush cane for *gur* making.

14. The real remedy is obviously to introduce power-crushing plant of sizes suitable to the cane area available and to the purchasing power and technical skill of the people. The success of such mills, in the comparatively few instances in which they have been tried, has resulted in a tendency to concentrate cane growing in their neighbourhood.

There is a very great difference between the rate of working of power and bullock mills. The results of comparative trials at Poona showed that a three-roller mill, with rollers 20″ × 14″, driven by an oil engine, could crush 4,500 lbs. of cane an hour, against 750 lbs. with a four-bullock mill, and 450 lbs. with a two-bullock mill. Experiments in the south of India with three-roller mills of horizontal type, with rollers 12 inches in diameter and 18 inches in length, driven by oil or gas engines, have conclusively shown that they can on an average extract 15 per cent. more juice from the cane than is usual with bullock mills. Such mills require about six b. h. p. to drive them; they can deal with from a ton to a ton and a half of cane per hour, and extract sufficient juice to yield from 200 to 250 pounds of *gur* per hour. Under favourable conditions, the output of such mills will rise to 300 pounds of *gur* per hour. Roughly, their rate of outturn is equal to that of six pairs of cattle working six bullock mills. As they can be driven almost continuously day and night through the working season, these power plants will do as much work as 24 to 30 pairs of bullocks, and bullocks can only be worked from five to six hours a day each without causing undue deterioration. Evidence is forthcoming to show that such power-driven mills can economically replace cattle for areas as small as 40 or 50 acres, and that even smaller types of power-driven mills can be advantageously employed for areas as low perhaps as 25 acres.

Where these small power-driven mills have been introduced, it has been definitely established that they have increased the value of the product from a given area of land by from 25 to 30 per cent. Part of this is due to the fact that the increased milling power enables the crop to be handled at exactly the time when the sucrose contents are greatest.

In Mysore such plants have been installed by sugarcane growers cultivating large areas; others have been installed at State expense in places where the concentration of cane growing justified the experiment; and more recently several have been established by co-operative societies which have been largely financed by State loans. No evidence has been produced to show that any one of these plants has been completely successful in regard to the important matter of continuous working during the season; but, year by year, it is claimed that the results are improving and that the ryots in the neighbourhood are beginning to rely more and more upon them.

The remarks below indicate the experience which has been gained in Mysore.

"There is as yet but little evidence to indicate the best way to encourage the development of these power plants. Most of the large growers of sugarcane have already adopted them. The ideal method is to form co-operative societies amongst the growers of the cane who will employ qualified experts to run the plants. In those instances in which small capitalists have taken over factories originally started by Government, there seems to have been a considerable amount of friction which has been injurious to both parties. Although a very considerable measure of success has been achieved, a great deal yet remains to be done to determine the nature of the organisation which should be encouraged to carry on and develope this method of preparing *gur* for the market. But an infinitesimal portion of the Indian sugar crop is so far dealt with in these small mills; yet the results obtained justify further work on a greatly extended scale."

It seems proved, then, that if the area under cane is to be increased, if heavy crops are to be grown, and if the present tremendous waste of juice is to be avoided, small power plants will have to be introduced in very large numbers. The preliminary demonstration work must be undertaken by Government. Progress has been hitherto very slow, except in Madras and Mysore. Every use possible should be made of *takavi*, of co-operative finance, and of the assistance of landlords, but it seems that, for some time to come, the most promising policy would be to encourage small capitalists to crush for local custom.

Improvements in *gur* manufacture and its effect on refineries.

15. The subsequent disposal of the juice is the next point for consideration.

The three main directions in which improvement of the *gur*-making process is being attempted are—(1) economy of fuel, (2) production of a better quality of *gur*, (3) avoidance of waste from burning and skimming. As regards the first point, there is no doubt that over quite considerable tracts, the cultivators find it possible to boil the *gur* without other fuel than the megass and trash. The Poona furnace has been for long demonstrated in various parts of India, and is an improvement on most local methods. Concurrently with the experimental work involved in replacing cattle power by oil engines or gas engines, efforts have been made in Madras to improve the arrangements for boiling down the juice, and, while finality in this direction has perhaps not been reached, great improvements have been effected by the introduction of a properly constructed megass-burning furnace, the hot gases from which pass under a series of pans. The price of *gur* varies a good deal according to quality; but the best qualities do not in all cases suit local tastes. There is, however, no reason why, with instruction, the ryot should not produce a very much better type of *gur* than at present. The soft, dirty *gur* of Bihar and the eastern districts of the United Provinces sells for only Rs. 4 per maund, while cleaner *gur* from the northern districts fetches Rs. 5. The former is mainly in demand for refining, and the production of a better *gur* in Bihar and the eastern United Provinces districts, with a consequent rise in prices, would also probably be fatal to the refining industry in the north. This would scarcely be a matter for regret, inasmuch as the cultivator turns out *gur* which fetches a far lower price from the refiner than he could get for a better made article from the ordinary consumer, while the refiner, by dealing with a sugar product which has already passed through a process which renders it less suitable for sugar manufacture than the juice from which it is made, wastes a proportion of the sugar available in the cane.

The amount of sugar obtained from *gur* refining is about 4·4 to 6 per cent. against 7 to 8 per cent. obtained by direct sugar manufacture from the cane. On the other hand, the decay of the refining industry has led to a rise in the price of molasses from Re. 0-9-6 a maund to three times that price, thereby affording a market for Java molasses, at one time a waste product, whilst at the same time enabling Java sugar to compete in India on more favourable terms.

The two main advantages to the large factory refining *gur*, as compared with the direct process of sugar manufacture are—(1) that the work can go on continuously throughout the year, and (2) the heavy capital outlay and recurring cost of crushing and concentration are avoided. The process as at present carried on, both as a sole industry and by cane-crushing factories in order to extend their working season, is not likely to die out for a long time, but it does not seem desirable to take any special steps to assist it.

Summary of proposals.

16. In this note proposals relating to agricultural improvement have been given the greatest prominence. They are generally as follows:—

The present improvement of cane should be encouraged in the southern provinces. In the United Provinces, a very special effort should be made by demonstrations, by grants of *takavi* loans, or by any suitable modification of the Formosa system, described in paragraph 3, to induce the people to take up the growing of superior canes and to manure them as heavily as the local factors of limitation will permit. A no less insistent campaign should be waged in favour of the small power mill. *Takavi,* co-operation, hire-purchase, and any other suitable system should be employed. Care should be taken to see that the machines are inspected often enough to keep them in good running order, and that *mistris* are made available for running them. Finally, in new areas like Burma and Assam, where agricultural conditions are naturally favourable, and the encumbrances of tenancy and other rights do not exist, every effort should be made by fair offers to induce concessionaires to come forward and build up a cane industry on modern lines. It seems probable that from these areas alone India may be able to obtain a very large proportion of the cane sugar that she now imports.

The above measures would undoubtedly lead to or render possible the establishment of more sugar factories, and, so far as European-managed factories are concerned, little more in the way of help is needed. For the benefit of small factories which cannot afford European supervision, however, separate expert advisers should be available for the United Provinces and for Bihar and Orissa. The propaganda of small power mills should not be in their hands; it can be carried out as well by a less highly paid specialist with a proper staff. The sugar expert's services should be given freely and fully to the smaller capitalist, especially at the start of his operations. For the conduct of his work, he should be enabled to experiment freely and under suitable conditions. He should have a small factory under his charge for this purpose and to train foremen for the use of the factories in his province.

APPENDIX D.

THE DEVELOPMENT OF THE INDIAN TANNING TRADE.

Extent of Indian trade in hides and skins (raw and tanned).

It has been calculated that in India there are about 180 million cattle and 87 million sheep and goats. Though it is only possible to form an approximate estimate of the total number of hides and skins which become available, there is very detailed information regarding the nature and value of such portion of the supply as is exported, either raw or in the form of leather, partly or completely manufactured. The value of the exports in the last four years extracted from the sea-borne trade returns is given below :—

Year.	Value of raw hides and skins exported. Lakhs.	Value of leather and tanned hide and skins exported. Lakhs.	Total. Lakhs.
1914-15	7,82	4,76	12,58
1915-16	9,79	5,64	15,43
1916-17	14,41	9,44	23,85
1917-18	7,84	6,37	14,21

* Provisional figures.

Except to those engaged in the trade, the voluminous figures contained in the statistical returns are of little interest; the history of the foreign trade is largely a record of the results of fiscal regulations. The United Kingdom has always taken the bulk of the tanned or dressed hides and a very large proportion of the tanned or dressed skins, while the raw material has gone to those countries which protected their manufacturers by the imposition of heavy duties on all but raw products. Till the war broke out, Germany, Austria, and Italy were the principal destinations to which raw hides were sent, and roughly three-fourths of the raw skins were purchased by the United States. Very little information is available regarding the internal consumption of hides and skins. Probably half the hides and nine-tenths of the skins available in the country are exported.

Effects of increasing value of raw materials.

2. Hides and skins may be regarded as a by-product of agriculture, the supply to the market being but little affected either one way or the other by the demand. The export trade, nevertheless, has, from the beginning, steadily expanded both in volume and value, and even more rapidly in value than in volume. Indian raw material fills an exceedingly important place in the leather markets of the world. Prices have constantly tended to rise, and important changes have thereby been brought about in respect of the internal consumption of leather. These will be discussed later on.

A return of the exports by sea from Fort St. George for the year 1846-47 shows that 48,212 hides valued at Rs. 22,423 were exported to the United Kingdom, the average value of each hide being Re. 0-7-5, whilst in 1912-13 the sea-borne trade returns show that 13,450,913 raw hides were exported from India valued at Rs. 8,05,86,105, or an average of Rs. 6 each. Similarly, raw skins in 1846-47 were worth Re. 0-3-2 each and in 1913-14 Re. 1-9-6.

This increase in the value of the raw material has naturally affected rural economy to some extent by stimulating the improvement of the organisation for collecting hides and skins. Formerly, they were the perquisite of the village *chuckler* or *chamar*, who tanned them in a primitive way and supplied the needs of the villagers in the matter of leather. The increased value of the hides and the ease with which they can be marketed have led the *chuckler*, in many places, to abandon the tanning business and to sell the hides to dealers for cash. It has also led the villager to dispute the *chuckler's* right to the hides and to employ him instead as an intermediary in the disposal of them; while he now purchases leather in the open market from the agents or middlemen of the organised tanneries and hands it over to a *chuckler* to make up into whatever he needs.

Peculiarities of Indian hides.

3. Indian hides differ a good deal in size according to locality and breed; speaking generally, the larger hides come from the Punjab, the north of the United Provinces, and parts of Bombay and Madras. The inferiority of Indian hides is only partly due to the poor quality of the cattle. Branding depreciates their value enormously and, as many of the cattle are used for draught work, their hides show signs of wear and tear. Only in the large towns, and more especially in the cantonments, are cattle killed for food, and the bulk of the hides available are those taken off animals which have died from disease, old age, or injury. "Slaughter-house" is an elastic term and is often applied to hides of good quality taken from animals that have died from natural causes, but strictly it is only applicable to those obtained from cattle which have been fattened up for killing. Slaughter-house hides proper are usually of good quality and, in the case of cow hides, might well be used for making sole leather; but their number is small. Hindus are very averse from killing animals, and they allow their cattle to linger on in sickness and old age. The animals suffer and naturally their hides deteriorate, but the most fruitful source of injury is the merciless way in which cattle are branded. This is carried on to such an extreme that many thousands of hides are absolutely ruined, and large numbers of them are depreciated fifty per cent in value through branding, which is done to satisfy the owner's æsthetic eye or calm his troubled mind. It is supposed to be efficacious in keeping away evil spirits and preventing disease, and it is also largely practised as a remedy for many diseases, especially in the nature of staggers or fits.

The prejudice against killing cattle is, however, disregarded in some parts of the country. In the Central Provinces and the United Provinces, "jerked" meat for export to Burma is prepared on a large scale, and there are a number of slaughter-houses at Agra, Damoh, Rahatgarh, Khurai, and other places, where thousands of cattle are slaughtered every day, and a trade not very dissimilar from that of the meat packers of Chicago is carried on. These establishments furnish large numbers of hides of a quality somewhat superior to those taken from the animals that die from natural causes, though the animals sent there for slaughter are usually past work.

Indian skins.

4. The term 'skins' is technically applied only to pelts of sheep and goats. Goat skins are larger, heavier, and of much better texture than sheep skins. Unlike hides, the majority of skins are derived from animals which have been slaughtered for food, and the pelts are, therefore, in a much better condition and will compare favourably with similar classes of skins from other parts of the world. The tanning of skins is practically confined to Bombay and Madras, and the bulk of the business is done in the latter Presidency, the tanners of which supplement the local supplies by importing largely from other parts of India. The quality of skins varies very much with the season of the year; but, unlike hides, they are generally at their worst during

the rainy season when the animals become feverish through exposure, and the effect shows in the pelts. The hair or wool grows longer on account of the cold, and this leads to loss of tissue, with the result that the pelt is thin and papery. The majority of the dried skins are exported to be chrome tanned in America or Europe and converted into glacé kid. Skins tanned by the chrome process do not gain substance like those prepared by vegetable tanning, and plump well-nurtured skins are, therefore, in great demand by chrome tanners. Anything less than a spread of 75 square feet per dozen skins is regarded as unsatisfactory. Moreover, every skin should be at least 21 inches wide, so that when converted into glacé kid, it may be possible to cut two sets of upper sides from each skin.

Establishment of western methods of tanning in India.

5. It is difficult to obtain information regarding the tanning of leather in India before the industry came under the influence of western methods. Judging by what is now done in remote districts, where the village tanner is still uninfluenced by modern methods of procedure, it is probable that the indigenous industry was in an extremely primitive condition and that only very inferior kinds of leather were produced. Tanneries of considerable size must have existed to supply the harness and saddlery for the enormous numbers of troops and retainers who were kept under arms by the numerous rajas, zemindars, and petty chieftains, who formerly exercised more or less independent sovereign powers throughout the country. The requirements of the town population were probably small and confined chiefly to sandals and vessels for holding oil and ghee; but the ryots used large quantities of village-tanned leather for water bags, for leather thongs, and for ropes.

European methods of tanning hides were first introduced by the military authorities to manufacture superior leather suitable for harness and other military accoutrements. Contemporaneously in the early forties of last century, a French Eurasian of Pondicherry, named D'Souza, introduced improvements in the native methods of preparing skins. He is said to have visited the island of Mauritius and to have there acquired a practical knowledge of the French processes of tanning and, on his return to Pondicherry, he started a tannery and, a little later, came to Madras and set up several small tanneries in the neighbourhood of that city, the products of which were probably exported to England. Of his improvements the most important was the immersion of the tanned skins in a bath of myrabolams after the ordinary tanning had been completed. This prevents a very objectionable change in colour which otherwise takes place on the exposure to sunlight of leather or skins tanned with *avaram* bark. There is no clear evidence that from his time till the advent of chrome tanning any further changes in the methods of tanning skins have been introduced into India. The small demand for highly finished skins in India was met by importation from Europe, and the somewhat crudely prepared Indian-dressed skins were welcomed by the tanners in Europe as the raw material from which to prepare the very best classes of light leather.

Growth of modern tanning industry.

6. The developments of leather manufacture in contradistinction to the light tannages of Madras and Bombay are almost entirely the outcome of military efforts to obtain suitable supplies for boots and accoutrements. Where arsenals were established, tanneries usually followed. At Cawnpore, the Government Harness and Saddlery Factory was started in 1860 on an experimental scale and, as it proved a success, it was placed on a permanent basis in 1867. Shortly afterwards, Messrs. Cooper and Allen started the Government Boot and Army Equipment Factory and, at the outset, they received a considerable amount of financial assistance from Government. A marked

degree of success has attended the efforts to develope the leather trade in Cawnpore, and, up till the time of the outbreak of war, the factories which have come into existence, though largely dependent on the army for orders, were by no means appanages to the military department.

The successful establishment of the industry on a large scale is due to the following facts:—(1) Cawnpore is a convenient centre for the collection of hides from Northern India; (2) at the outset, there were large supplies of cheap *babul* bark, an excellent tanning material; (3) the business was in the hands of enterprising Europeans; and (4) their efforts were viewed with favour, and largely assisted by Government, who provided a market in the early days for the bulk of the outturn. Working on similar lines, but on a much smaller scale, an enterprising Khoja Muhammadan, Adamjee Peerbhoy, established at Sion, in Bombay, the Western India Army Boot and Equipment Factory. In Europe and America machinery is very largely employed in tanneries and leather-working factories but, although it has been employed on a considerable scale in the Cawnpore and Sion factories, elsewhere, till quite recently, it was conspicuous by its absence in the Indian tanneries, which produced the whole of the half-tanned leather and skins that bulk largely in the export trade of the country.

Chrome tanning in India.

7. The action of various chemicals on hide substance has been the subject of scientific investigation for many years past and, about 1895, the method of producing leather by means of chromium salts was thoroughly established in America on a commercial basis. The process was also taken up on the Continent and, somewhat more slowly and at a rather later date, by English tanners. Some experiments were made in India both in Cawnpore and Madras; but they resulted in nothing practical till, in 1903, the proposal was made in Madras to use leather prepared by this process for water bags for the country *mhots*. The experiments proved successful and resulted in the establishment of a Government factory, in which chrome leather was manufactured on a considerable scale and applied to a variety of purposes in place of bark-tanned leather. The history of this factory will be found in Appendix J. That it was prematurely closed there seems to be no doubt, as the progress of chrome tanning in India has been much slower than it is reasonable to anticipate would have been the case had Government assistance in pioneering the industry been given for a longer period. The developments have followed the line of least resistance, and, in the hands of private individuals, immediate profit has naturally been of greater importance than ultimate development. Of the chrome tanneries which were started, seven or eight have survived the initial difficulties and are now mainly employed on the manufacture of leather for sandals and boots and shoes. The manufacture of black and brown box sides has been developed on a considerable scale, and this completely finished leather has found a profitable market in Great Britain.

At the outset, it was thought that there would be a very large market for chrome leather for water bags, but progress in this direction has been comparatively slow. The rise in the price of leather has led the ryots to use light iron buckets, and competition with them left comparatively little profit to the chrome tanner. The Madras Tannery was the first in the south of India to introduce the use of machinery in the tanning processes, and the success with which such machinery has been working has led to its adoption to some extent in bark tanneries. This latter development is a matter of some importance, as it has engendered a more progressive attitude amongst the Indian tanners.

Efforts of the Munitions Board to stimulate manufacture of leather articles.

8. Evidence of this is visible in the success which has attended the efforts of the Indian Munitions Board to stimulate the manufacture in India of certain classes of leather goods previously imported from abroad. The scrutiny of applications for priority drew attention to the possible market for locally manufactured roller skins, picker bands, leather belting, and raw hide pickers. Early in June 1917 the Board accordingly informed Indian firms that if they could satisfy it, by production of suitable samples, that these articles could be made in India, priority applications for import from abroad would be refused. A number of the more recently established tanneries of the improved type took the matter up with most encouraging results and, with regard to roller skins and picker bands, it is understood that they have no difficulty in disposing of their outturn. The manufacture of leather belting and of raw hide pickers proved a matter of greater difficulty, and experiments are still in progress. Excellent belting has been made from specially selected hides, but the general average is not yet up to the required standard. In regard to pickers, the large sizes used on jute looms are working satisfactorily, but the smaller pickers for cotton looms still leave much to be desired.

Effects of the war on the tanning and leather trades.

9. The position of the leather trade in India at the present time may now be summed up briefly. The highest developments of manufacture at the outbreak of war were to be found in factories most intimately associated with the supply of material for military purposes and in the smaller tanneries devoted to the production of chrome leather. The bulk of the leather made in the country was either for internal consumption and of inferior quality or for export as half-tanned leather, to which the trade applied the term 'East India Kips'. Practically, the export trade was confined to Madras and Bombay, and was chiefly to Great Britain and, to a much smaller extent, to the United States of America and to Japan.

Some time after the outbreak of war, the value of the 'East India Kips' as upper leather for army boots was realised in England, and efforts were made to increase and regulate the supply. From August 1916 the Indian Government, at the request of the War Office, assumed complete control of the trade and took over from the tanners the whole of their output. The arrangements made by the Commerce and Industry Department were transferred to the Indian Munitions Board, after its creation in March 1917. In pre-war years, the exports were below 200,000 cwt., of a value of less than two crores of rupees. In the year 1917-18 they reached 360,000 cwt., of a value approaching five crores of rupees. Roughly, in four years, the output of the Indian tanneries for this class of leather only has been doubled. The control of the trade has enabled some minor, but very important, improvements to be effected, the chief of which are the prevention of adulteration and the elimination of faulty flaying. This great development of hide tanning has been accomplished in the face of grave difficulties due to inelasticity in the supplies of tanning bark, and it has been necessary to take action in several directions to maintain the output of tanned hides. The Indian export trade in tanned hides and tanned skins was confined to the south of India where the bark of Cassia auriculata, known in Madras as *avaram* and in Bombay as *tarwad,* is obtainable. Elsewhere, the cost of railway freight makes tanning with this bark commercially unprofitable. The increased demand for tanning materials has led to a great rise in prices and has more than doubled the cost of tanning. The attention of Local Governments has, therefore, been directed to the urgent necessity for measures to increase the supplies of *avaram* bark, either by more careful collection or by cultivation on an extensive scale. To meet the increasingly urgent demands of the military authorities for more leather, it became necessary to prohibit the tanning of skins, which not only rendered available for hide tanning the bark previously used for skin tanning, but led to many of the skin tanners taking up hide tanning instead. These measures have produced immediate results; but attention is also being directed to the provision of substitutes for *avaram* bark. To this end, the Indian Munitions Board has entered into an arrangement with the Esociet Company at Maihar in Central India, whereby it has taken over the experimental tannery and the staff employed on research work, and it has purchased a tannery in Allahabad with a view to ascertaining the commercial value of the conclusions reached in the research factory. Promising results have already been obtained from a variety of mixtures of Northern and Central India tan-stuffs and it is anticipated that, ultimately, it will be possible to provide tanning material of as good a quality as *avaram* bark for a great extension of tanning in Northern and Central India. As will be seen in the sequel, the success of these efforts to develope fresh supplies of tanning materials will greatly strengthen India's position in the leather trade after the war.

Possibilities of expansion of tanning in India.

10. The problem of the future is how to obtain for India a larger share in the work of preparing her abundant raw material for the market. The limits of reference preclude any discussion of the tariff question and, though the trade has been, and will continue to be, affected by whatever fiscal policy is adopted, in what follows it is assumed that if sufficiently good finished material be produced, it will be possible to sell it at profitable prices. The steady rise in the value of Indian hides in the years immediately preceding the war may be reasonably accepted as evidence that the demand for the commodity was in excess of the supply, and it may be contended that the contribution to the world's markets which India is able to make is of sufficient importance to enable her to dictate in what form it shall leave the country.

The position is perfectly clear. There is a very large, but limited, supply of Indian hides, which was not sufficient to meet the demands made upon it in pre-war times, and it may be confidently anticipated that these demands will increase after the war, owing to the diminution in the number of cattle in belligerent countries. It seems certain, therefore, that for a long time to come there will be a very serious shortage of hides and leather. From the Indian raw material, by the exercise of skill, experience, and technical knowledge, a valuable leather can be made either on the Continent, in Great Britain, or in India. If it is made in India, by exactly the quantity made will the stock of hides available for export be diminished. For India to obtain advantage from the situation it is necessary to make as good a leather out here from the local hides as can be made from the same hides elsewhere. The production of an inferior quality of leather will involve heavy loss, as it will only fetch a low price in competition with good leather made from similar material. There must, therefore, be no waste in this direction.

It is, therefore, not altogether unreasonable to assume that the future of the Indian leather trade can be usefully discussed without any reference to tariffs, although these will of necessity play an extremely important part in the transition period during which the export trade is being changed from one mainly in raw hides to one of tanned hides or finished leather.

Necessity for expert investigation.

11. While the best Indian raw hides are distinctly inferior to the best produced under more favourable conditions in temperate climates, the Indian goat skins are of high grade and suited for first-class work. But from these skins Indian tanners have not so far been able to produce finished goods of anything like the quality that can be manufactured from them in Europe and

America. In explanation of this, it has been alleged that in India it is too hot to produce first-class work, and there is no doubt whatever that the high temperature of the soaks and lime pits is a disadvantage. Tanning under tropical conditions has never been carefully studied by experts with both a scientific and practical knowledge of the trade. The experimental tannery started by the Department of Industries in Madras was the first practical recognition of the necessity for such work. It is unfortunate that, for reasons arising out of the war, there has been delay in taking up this matter, and it is unquestionably urgent that the obstacles which have hitherto prevailed should be overcome as soon as possible. It may almost be accepted as axiomatic that the development of the Indian leather trade can only be accomplished by bringing to its assistance technically trained men, qualified to deal with the local problems and capable of modifying European and American methods to suit local conditions.

It is obvious that India cannot afford to neglect any of the advantages enjoyed by the tanning trade in other countries, and it may be regarded as essential that adequate provision should be made, as early as possible, for the investigation of tanning methods in India. The Madras experimental factory was a step in the right direction; but it was started on a scale that is now inadequate to meet the more urgent situation which has arisen since it was first proposed.

The experimental work at Maihar under the Indian Munitions Board has already been mentioned and the results obtained so far are sufficiently promising to warrant its continuance with a stronger expert staff. We understand that Maihar was selected by the Indian Munitions Board because important researches had already been started there and the expense of establishing a new laboratory and factory could be avoided, but it will be necessary to consider later the locality most suitable for a permanent research station. If found necessary, these experimental investigations should be transferred to a site better adapted for the wider scope of the work now contemplated. Already, we understand, no little inconvenience has been caused by the distance between the research work at Maihar and the commercial experiments which are in progress at Allahabad. The conditions in India in respect of the supply of raw material, both hides and skins and tan-stuffs, vary considerably, and it is possible that there may be scope for combined research laboratories and experimental tanneries at such centres as Calcutta, Madras, Allahabad, and possibly Bombay. It will also probably be necessary, when the research work has yielded the expected results, to establish Government tanneries elsewhere, in which to demonstrate the value of the new tanning materials and the changes in tanning practice involved in their use. We contemplate that, ultimately, these factories should be handed over to private enterprise, but not while they are found to serve a useful purpose either by way of demonstration or as training centres.

Proposals for training Indian tanners.

12. The question arises as to what provision should be made for the technical instruction of men who will afterwards be in charge of tanneries. Neither experimental nor demonstration factories are suited for such work, and it is not advisable to use them for this purpose.

Hitherto, the Indian trade has been run by *mistris* possessed of much practical experience, but absolutely ignorant of the most elementary knowledge of the principles underlying their practice. It is generally recognised that this can no longer continue, and that if India is to gain the position in the leather world to which she is entitled by reason of the abundance of raw material at her command, the tanning and leather industries must pass under the control of expert technologists, and scientific methods must replace empirical and rule-of-thumb working. Tanning is a chemical industry, in certain stages of which bacteria play an important part, and those who, in the future, would control the industry must be capable of understanding the scientific principles underlying its technique. This means that the students before admission to the tanning trade school should have received a scientific education and should possess a fair knowledge of physics and chemistry. We may take it that the expert tanner of the future should be a graduate in science, and it will be best that his technical studies should only begin after he has completed a university course in pure science. The training in technology must be followed by work in a factory to gain practical experience. These tanning trade schools should be placed alongside the research institutes, which we contemplate will be necessary, and they should be linked up with a college of science on the one hand and a tannery on the other. Ideal conditions would suggest that they should be established in centres of the tanning trade which possess science schools of the highest grade. In such places it would then be convenient to carry on all the work connected with the scientific development of the tanning industry, and the experts dealing with the various branches would be in close touch with one another. There would be the experimental laboratories in which investigations would be going on. Adjoining them, but under independent control, would be the tanning trade schools and, as near as industrial considerations and municipal regulations permit, should be the factories in which the processes worked out in the experimental laboratories would be tried, and where the students from the trade schools would acquire practical experience.

The inferior quality of Indian products is also due to the inferior skill and knowledge of the Indian workmen, especially in respect of the finishing of leathers. Outside the factories engaged on military work, and outside the few small ones which have sprung up as a result of the Madras efforts to introduce chrome tanning, neither currying nor finishing leather is understood or practised, and whatever work is necessary in this direction is undertaken by the Indian *chuckler*, as a preliminary to the actual work of making the article which he has in hand. This can be remedied in the demonstration factories if skilled workmen are obtained from Europe to act as instructors.

Prospect of leather industries in India.

13. The imports into India of finished leather and of goods made from leather are not unimportant, but many of them are the products of specialised factories, which it will not pay to establish in this country till the demand is very much greater than it is at the present time. These imports include :—

(1) Boots and shoes to the value of three or four hundred thousand pounds a year, of which probably two-thirds might well be made in the country.

(2) Belting: the value* of the imported leather belting is very considerable and is likely to increase with the industrial development of the country. Belting can be made in India from selected hides. From the average raw material available it is certain that India will not be able to compete in quality with imported belting, and it is, therefore, unlikely that there will be any serious development in the direction of replacing imports by local manufactures.

*1912-13 . . .	£138,085
1913-14 . . .	167,527
1914-15 . . .	132,315
1915-16 . . .	166,554
1916-17 . . .	203,048

(3) High-class finished leather and heavy leather: the imports are not very large; but it is hardly likely that they will be replaced by leather of equal quality tanned in the country.

(4) Finished skins are imported in large numbers, but there is absolutely no reason why, when skin tanning is properly carried on, these should not be almost entirely made in the country.

The textile mills require large numbers of roller skins, and hitherto these have been imported; but, owing to the stress of war, they are now being made in the country, and in the future importation should entirely cease. The same should be the case with other mill requisites, such as picker bands and raw hide pickers.

The rest of the imports, including saddlery and harness, are of a miscellaneous character, and though some may ultimately be replaced by goods of equal quality manufactured in the country, it is likely that the bulk of these will increase with the growing needs of the country rather than diminish.

The internal consumption of Indian-made leather is by no means accurately known. There are few parts of the country in which the village tanner does not still exist, and there are many small local tanneries of a slightly improved character in the south of India from which the agricultural population gets what it wants.

By far the most important item for which leather is required in India is the water bag by which water is lifted from millions of wells for the irrigation of the fields. To an appreciable extent, in recent years, iron buckets have replaced leather, and efforts are now being made to introduce cheaper fabrics made from vegetable fibres. It is not improbable that the use of leather for this purpose will steadily decrease, and, if such be the case, it will increase the visible supplies of hides on the market.

The Indian demand for boots and shoes and sandals is on the increase; but it is small as yet compared with the vast population. That it will grow in the future is a certainty, and it is likely that for boot uppers and sandals chrome leather will be very largely used. Chrome sole leather has been extensively tried and has proved extremely durable, and, in a country where pavements do not exist, the objection that it is slippery in wet weather has not the force which has practically precluded its use for footwear elsewhere.

The Indian tanning trade must, therefore, look to foreign markets for the sale of its products, and the quantity of raw material is so enormous that it will ultimately need very many large establishments to deal with it, and a high degree of specialisation seems at least possible.

Suggested developments of chrome tanning and leather manufacture.

14. There is not the smallest doubt that foreign countries will endeavour to secure the Indian raw material and to refuse Indian-manufactured leather, as in the past. Assuming, however, that they cannot get the former, they will undoubtedly accept the latter. Future developments must to a large extent depend upon the work done in the experimental factories which have been recommended; but already sufficient experience has been accumulated to show that it is possible to export from India finished leather which meets with a ready market in the United Kingdom. The export of black and brown box sides has reached considerable dimensions, and it is unfortunate that the exigencies of the military situation have temporarily put a stop to this business. A considerable proportion of the Indian cow hides is eminently suited for this class of work and, if it is taken up on a sufficiently large scale under the control of experts in this branch of the leather trade, there are

reasonable prospects of a very extensive commercial development. A large capital will be required to carry on the industry, as this branch of tanning requires workshops equipped with modern machinery. Two important factors will determine the best sites for this branch of the trade:—

(1) The factory must be situated at a centre convenient for collecting the raw material, and this centre should, if possible, be a port where power can be cheaply generated.

(2) There should be in the neighbourhood a sufficient population of the castes willing to work in a leather factory, and capable of being converted into skilled workmen by careful training. The suburbs of both Calcutta and Madras probably best fulfil these requirements, and it is recommended that attention should first be drawn to them as possible sites for the factories which, we hope, will be started.

As has been already indicated, the skins exported from India are of excellent quality; but the attempts to produce finely dressed skins in India have hitherto proved a failure. It is alleged that this is due to the climate, but we are unable finally to accept this verdict. Experimental work under the direction of highly qualified men should be undertaken, and there is little doubt that it will result in success, and in the future it is reasonable to hope that glacé kid, which is now largely made from Indian goat skins, will be exported; also that other finished leathers, such as moroccos, roans, calf skins, and roller skins, will be manufactured not only to meet the needs of India, but to supply those of other countries.

It must, however, be admitted that a very large amount of preliminary work has yet to be done before this branch of the trade can be established so as to compete with the products of countries in which the manufacture is now carried on.

Strong position of India after the war.

15. Till the war is over, and it is possible to form some idea of the international adjustments which will follow, it will be difficult to propose, even in broad outline, the policy which India should adopt to secure for herself the advantages arising out of her resources in hides and skins. The outstanding feature at the present moment is the large increase in light tanning, but this, owing to the scarcity of suitable tanning materials, has to some extent been accomplished at the expense of the skin trade. The continuance, therefore, of the present expansion after the war depends, so far as India is concerned, on the success of the measures which have been taken to provide further supplies; also on whether the external demand for these light tannages for boot uppers remains when military orders cease to dominate the situation. It may be taken as practically certain that there will be a very large increase of tanning materials; but it is less certain that the demand for light tannages will continue on the present scale, and of course much less certain that it will increase. For civilian footware chrome-tanned uppers are now mainly employed, and there is little prospect of any change in this. In the years immediately preceding the war Germany exported to Great Britain on an average more than a million pounds worth of this class of chrome leather and over £400,000 worth of enamelled or patent leathers. Presumably these leathers were largely made from raw materials exported from India, as the German imports were eminently suited for the purpose. In the future, it may

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